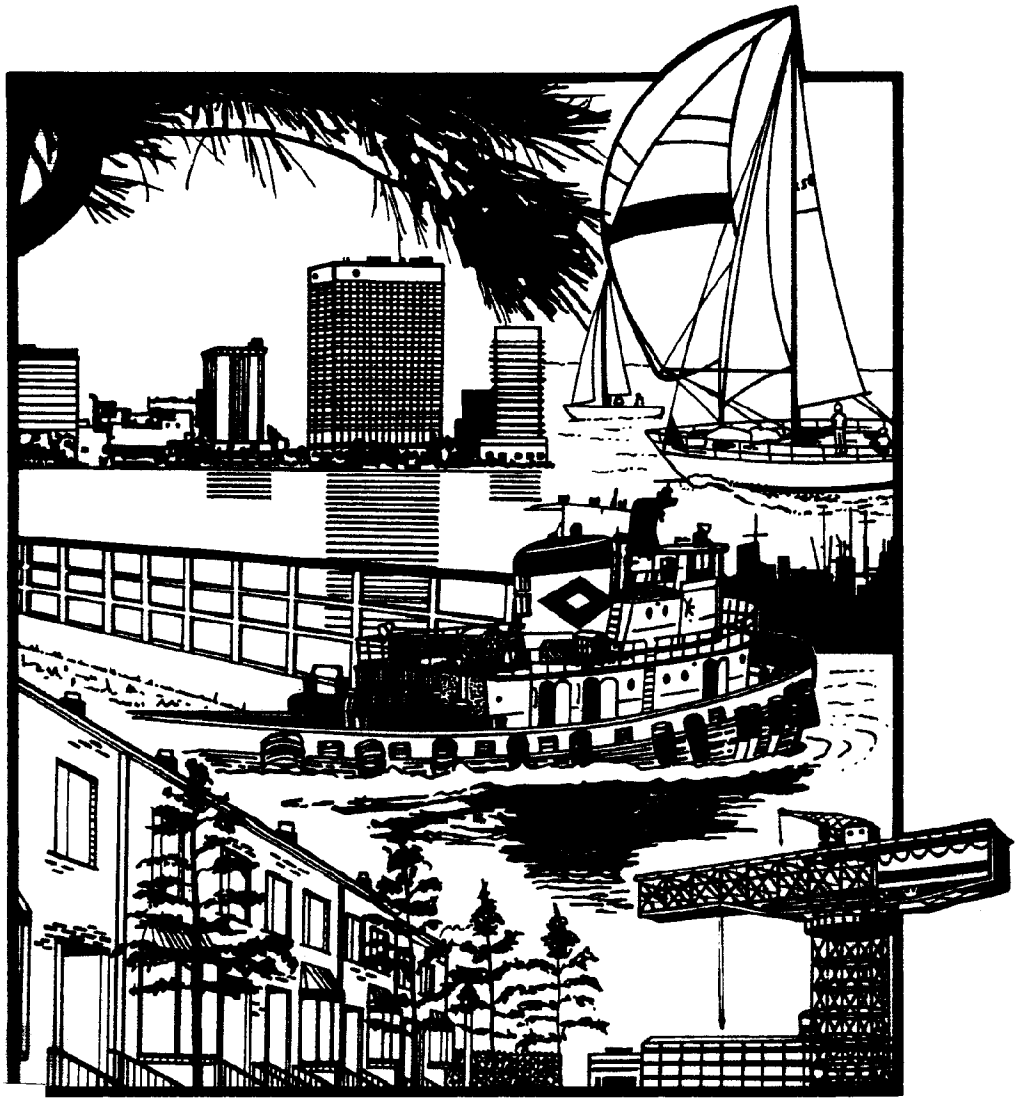
ELIZABETH RIVER BASIN ENVIRONMENTAL MANAGEMENT PROGRAM



EPARED BY SOUTHEASTERN VIRGINIA PLANNING DISTRICT COMMISSION
WITH THE HAMPTON ROADS WATER QUALITY AGENCY
MAY 1989

APPENDICES

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ENVIRONMENTAL MANAGEMENT PROGRAM

FOR

ELIZABETH RIVER BASIN

APPENDICES

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Prepared by the Staff of the
Southeastern Virginia Planning District Commission
with the
Hampton Roads Water Quality Agency

MAY 1989

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APPENDIX A

IMPLEMENTATION STATUS OF

COMPREHENSIVE ELIZABETH RIVER WATER QUALITY

MANAGEMENT PLAN: PRELIMINARY MANAGEMENT RECOMMENDATIONS

The Comprehensive Elizabeth River Water Quality Management Plan: Preliminary Management Recommendations (CERWQMP: PMR) was completed in 1986. Since that time, action has been taken to implement a number of the Preliminary Management Recommendations. The current (1989) implementation status of each of those recommendations is documented in the following section. Where several recommendations dealt with one issue, they are grouped and the implementation status of the entire group is described.

PMR #01 *The Nonpoint Source Control Strategy, documented in the HRWQMP: Plan Update 1983, and discussed in the SVPDC report referenced above, is recommended as the overall nonpoint source management framework. The agencies given implementation responsibilities in that Strategy should assume those responsibilities if they have not already done so.*

The Nonpoint Source Control Strategy has continued to serve as the regional framework for nonpoint source pollution control and management. Specific actions to implement the intent of this strategy have been undertaken by both state and local agencies and the private sector. Most noteworthy of these are:

- Adoption by the City of Virginia Beach of a Stormwater Management Ordinance and associated amendments to other land development regulations. This Ordinance requires the use of Best Management Practices in most land development activity. The City is presently expanding its staff capability to implement this program.[1]

- The City of Norfolk has reorganized staff responsibilities for stormwater management and nonpoint source pollution control. These programs are now housed in the Department of Public Utilities, along with a new watershed management program, designed to protect the City's water supply lakes from the adverse impacts of nonpoint source pollution. Also, environmental planning staff capability has been added to the Utilities Department. Through a further reorganization, it is anticipated that the Division of Environmental Services will be added to the Department of City Planning later this year.

- The City of Portsmouth has adopted a Wetlands Ordinance and established a local Wetlands Board. The City has also developed a Shoreline component of its Comprehensive Plan.[2]

- The City of Chesapeake has included a number of policies and objectives directed at water quality management in its Comprehensive Plan.[3]

- All communities have increased staff responsible for erosion and sediment control, stormwater management and associated enforcement. Additionally, all basin communities are working individually and with the Hampton Roads Water Quality Agency and the SVPDC in the development of responses to new EPA regulations for the permitting of stormwater discharges.

- At the state level, new management strategies have been developed by the State Water Control Board and the Division of Soil and Water Conservation.

The federal Clean Water Act of 1987 established two new programs in the area of stormwater management and nonpoint source pollution control. They are the Section 319 Nonpoint Source Management Program and the Section 402 Stormwater Permitting Program. To assist the local governments in addressing these programs, the SVPDC is revising the Nonpoint Source Control Strategy through a CRMP-funded project - Regional Stormwater Management Strategy for Southeastern Virginia. That program is discussed in Appendix F and in a companion report.

PMR #02 *The Cities of Chesapeake, Norfolk, Portsmouth and Virginia Beach should formally adopt water quality protection and/or management as a City goal.*

PMR #03 *Following adoption of PMR #02, the localities should incorporate that goal as an underlying premise of their comprehensive plan. Specific policies, reflecting that goal, should then be established to guide development in the various neighborhoods and communities within the Elizabeth River Basin. Concurrently, the cities should consider adoption of such policies for development in other basins.*

Steps have or are being taken by each of the four basin communities to implement these recommendations. The Cities of Chesapeake and Portsmouth are finalizing major updates to their Comprehensive Plans, both of which include statements of City goals and policies directed at water quality protection and management. Specific water quality management strategies are to be included in the implementation program for these Plans and the related land development ordinances. The SVPDC and HRWQA staffs have worked closely with the local government staffs in the development of these implementation programs. The Cities of Norfolk and Virginia Beach are in the process of revising their Comprehensive Plans. Both revisions are expected to be completed in 1990. Additional consideration of environmental issues, including water quality, is

expected. Again, regional environmental staff are working closely with the local governments staffs in the development of these Plan updates.

The 1988 Session of the Virginia General Assembly enacted the Chesapeake Bay Preservation Act (CBPA), enabling local governments to explicitly consider water quality protection in their Comprehensive Plans and associated land use regulations. The CBPA established the Chesapeake Bay Local Assistance Board and Department. It also established a formal program for regulating land use for water quality purposes in a portion of the Chesapeake Bay Watershed, those localities defined in the Virginia Code as Tidewater Virginia. Specific criteria and regulations to implement that component of the CBPA are being developed and are to be effective in July 1989.[4] Additional local consideration of water quality in the land use development process will result. The staffs of the SVPDC and the HRWQA have worked closely with the local government staffs in addressing this program.

PMR #04 *Basin localities and the SWCB should endorse the Tiered Critical Management Area for the Elizabeth river, as described in the companion SVPDC report.*

No action has been taken by state or local agencies on the Tiered Critical Management Area, proposed in the CERWQMP: PMR. The appropriateness of that recommendation in light of the passage of the CBPA is evaluated in Appendix E.

PMR #05 *Enforcement of erosion and sediment control ordinances should be increased. Concurrently, greater consistency of application within jurisdictions and the basin as a whole should be sought. Increased coordination among city departments would also be desirable. These needs were cited regularly during the User Group Task Force discussions.*

Several of the local governments have increased staffing for erosion and sediment control programs. Further increases are anticipated to implement the requirements of the CBPA, modifications to the state Erosion and Sediment Control Law and the above-noted changes to the federal Clean Water Act. Efforts to coordinate City departments have also occurred through internal reorganizations and the establishment in Virginia Beach of an Office of Environmental Programs. Also, through the SVPDC and the Hampton Roads Heavy Utility Contractors Association, a program to standardize construction and design specifications for utility projects is underway.

PMR #06 *Best Management Practices (BMPs) should be required on all new development within the Basin which is subject to*

the requirements for an erosion and sediment control plan. The initial priority for BMP implementation should be placed on development occurring on the transitional parcels and on development involving the use or handling of hazardous materials and wastes.

As noted earlier, the City of Virginia Beach has adopted a Stormwater Management Ordinance requiring the use of Best Management Practices in land development. In other communities, an increase in the use of proffered conditions, including stormwater and nonpoint source management techniques, during rezoning has been observed.

PMR #07 *A statewide ban on the use of tributyltin (TBT) antifoulant coatings on vessels 25 meters or less in length, except where vessel material composition including appurtenances (aluminum, etc.) allows no alternatives, should be developed and enacted.*

PMR #08 *A program requiring all vessel applications of tributyltin antifoulant coatings to have a leaching rate of less than or equal to 0.1 ug/cm^2/day should be developed.*

PMR #09 *Research into the environmental impact of all uses of tributyltin and its relatives should continue and new regulatory programs should be developed as present uncertainties are eliminated.*

PMR #10 *In conjunction with PMR #09, the State should conduct or contract for an inventory of all tributyltin usage in the basin.*

In its 1987 Session, the Virginia General Assembly enacted the recommended ban on the use of tributyltin antifoulant coatings. Implementing regulations, including instream water quality standards, have been adopted by the State Water Control Board and the Virginia Department of Agriculture and Consumer Services. The adopted state water quality standard for TBT is 0.026 parts per billion for freshwater and 0.001 parts per billion for saltwater. These standards represent the maximum allowable instream concentration.[5] The TBT regulatory program has been included in the Virginia Coastal Resources Management Program as an enforceable policy of that program.

The federal government has also taken steps to regulate the use of tributyltin antifoulant coatings. In 1988, Congress passed the Organotin Antifouling Paint Control Act, containing both interim and permanent restrictions on the use of TBT.

This legislation restricts the use of TBT to those formulations having a release rate of 4.0 ug/cm2/day and prohibits their use on non-aluminum hulled vessels less than 65 feet in length. In October 1988, EPA announced its intent to cancel registrations and deny certifications of TBT as an approved pesticide unless a specific formulation complies with these restrictions.[6] This action reinforces the state actions.

In its notice, EPA also indicated its intent to continue research into the effects of TBT on aquatic resources. Included among its research activities is an environmental modelling effort in Norfolk Harbor. This program will attempt to estimate the impact of possible regulatory approaches on TBT concentrations, based on an evaluation of the instream concentrations associated with several TBT loading levels. It is expected that this study will continue and serve, in part, as the basis for future EPA regulatory actions.

Future state and EPA regulatory actions will also reflect the results of ongoing monitoring being conducted by the SWCB. Special monitoring and reporting requirements are included in Virginia Pollution Discharge Elimination System permits for all facilities which actively apply or remove TBT paints. Beginning in Summer 1989, the SWCB will also conduct quarterly monitoring of ambient TBT levels in the waters of Hampton Roads Harbor, including the Elizabeth River. The SWCB indicates that several facilities have discontinued the application of TBT since the standard was adopted.

PMR #11 *Enforcement of existing discharge permit limits for drydocks, marine railways, and other ship construction/repair/refurbishing areas must be continued and enhanced where appropriate.*

It is apparent that the SWCB has increased its enforcement of these permit limits over the last three years. Enforcement actions have been taken against the Norfolk Naval Shipyard as well as private yards. Both the Naval Shipyard and Norfolk Shipbuilding and Drydock have been included on the recent list of Toxic Dischargers, submitted to EPA. Inclusion on this list will result in increased scrutiny of discharges from these sources.

The SWCB has received a grant from the National Oceanic and Atmospheric Administration to develop a BMP Guidance Manual for nonpoint source management at shipyards. That effort, which is presently underway, is being conducted as part of the SWCB's Elizabeth River Initiative. Initial efforts are concentrated at three shipyards on the Elizabeth River. New VPDES permits for shipyard discharges already contain new, more specific language concerning BMP implementation. Included are requirements for biological and chemical testing of washdown water from floating drydocks.

PMR #12 *The regulatory responsibilities of all State agencies involved in managing particulate emissions from the above waterline vessel building, vessel repair, and vessel refurbishing activities must be clarified and a comprehensive management and enforcement program developed.*

This issue is being addressed through the aforementioned Shipyard BMP Project. It will be examined further in future SWCB Special Projects and will include all shipyards. One issue, which must be considered in the future, is the impact and potential for restrictions on blasting activities in wet slips.

PMR #13 *The Virginia Department of Transportation should develop mandatory abrasive blasting containment and cleanup regulations for implementation by its contractors as well as its own work force.*

The SWCB has taken no action on this recommendation. It is not known whether VDOT has taken action.

PMR #14 *Public education and information programs conducted by state, regional and local agencies should be continued and augmented. These programs should focus on the good-housekeeping practices that can be implemented by homeowners and other residents. Opportunities to "piggy-back" these programs with similar programs on coastal resources, hazardous waste, and others may exist. They should be explored and used to the maximum extent feasible.*

Numerous public education program have been or are being conducted. Many of these include "piggy-back" elements linking them to related programs. Representative efforts include:

- The Southeastern Public Service Authority of Virginia has conducted a series of Household Hazardous Waste Collection Days, providing an opportunity for homeowners to properly dispose of household chemicals. Collection days were held during Fall 1987 and 1988 and Spring 1989. In June 1989 a permanent collection point will be established.

- SPSA and area localities have established a pilot recycling program for residential solid waste. Also, permanent collection points for used oil and other wastes have been established by SPSA.

- The SVPDC prepared and distributed The Value of Wetlands: A Guide for Citizens in 1988. This document, prepared through the Virginia CRMP, includes suggestions for citizens to use in protecting water quality as well as wetlands.[7] Similar efforts have been undertaken by the Chesapeake Bay Commission and the Chesapeake Bay Foundation.

- Public education programs are being conducted by the SWCB, Division of Soil and Water Conservation, Department of Waste Management, Council on the Environment and a variety of other state agencies.

Publicity inherent to the aforementioned SPSA programs has stressed the need for proper disposal of these materials. Users have been advised to not pour the materials on the ground or down the drain. Also, the amount of educational information available at Garden Centers and other retail distributors of such materials has increased. This material generally discusses the water quality implications of improper use and disposal.

PMR #15 *The SWCB should use the monitoring program proposed by the Hampton Roads Sanitation District as a model for other major dischargers in the basin. That program combines toxic monitoring of the effluent stream with in-stream response evaluations, thereby providing static as well as real world dynamic conclusions regarding environmental fate and effect. It also includes industrial pretreatment and control and comprehensive influent, effluent and residuals solids monitoring.*

A description of the current status of this recommendation is included in the discussion of Preliminary Management Recommendation #27.

PMR #16 *The State legislature should enact a phosphate detergent ban.*

The phosphate detergent ban was enacted by the General Assembly during its 1987 Session. Since enactment of the ban, the Hampton Roads Sanitation District has observed greatly reduced amounts and concentrations of phosphates in influent reaching its wastewater treatment plants. This has resulted in significant reductions in effluent loadings from the plants.

PMR #17 *The SWCB, Hampton Roads Sanitation District and City of Portsmouth should continue efforts to construct and operate the Virginia Initiative Plant combining the Pinners Point and Lamberts Point discharges at the present Lamberts Point discharge location. Present plans for operating an advanced secondary treatment facility with biological phosphorus and nitrogen removal is endorsed.*

Construction of the Virginia Initiative Plant (VIP) is underway with completion scheduled for Spring 1992. The underwater section of the Elizabeth River Crossing, connecting the old Portsmouth Pinners Point Plant with the old HRSD Lamberts Point Plant, is complete. The land portion of this pipeline is under construction. HRSD is working with the City of Norfolk to evaluate the feasibility of treating wastewater from Norfolk's 37th Street Water Treatment Plant at the VIP.

PMR #18 *A long-term monitoring program as recommended in PMR #15 should be followed for the VIP and the results used in determining the appropriateness of nutrient removal as a requirement for other basin dischargers.*

HRSD is conducting the long-term monitoring program recommended above. It is premature to use the results of that program to determine specific requirements for nutrient removal at other Basin discharges. Also, the SWCB has initiated a long-term Elizabeth River Monitoring Program. The question of nutrient removal has been rendered moot by the SWCB adoption of specific standards for nutrient enriched waters, discussed in the next item.

PMR #19 *In conjunction with PMR #18, the SWCB should establish algal productivity standards for receiving waters and attendant nutrient discharge control needs on a site- by-site basis.*

In conjunction with the Chesapeake Bay Program, the SWCB has established phosphate standards for all streams that are tributary to the Chesapeake Bay.[8] The standards were developed through the work of a Task Force including representatives of the SWCB and the state research institutions. It was decided that the standards should be expressed in terms of nutrient concentrations rather than algal productivity. The limitation on phosphorus loadings has been established at 2 mg/l. At the present time, the "Policy for Nutrient Enriched Waters" allows dischargers one additional year to meet the phosphorus limitation if they voluntarily agree to limit nitrogen loadings to no more than 10 mg/l.[9] The Elizabeth River is classified as a "nutrient enriched waterbody".

As noted above, the State phosphate ban has resulted in improvements to nutrient loadings and treatment performance at HRSD wastewater treatment plants. However, additional plant modifications will be required to enable HRSD facilities to meet the July 1991 standard for phosphorus loading.

PMR #20 *All sanitary sewerage collection systems and components should be upgraded to meet Virginia Sewerage Regulations Class I reliability standards.*

Current SWCB and Department of Health regulations require that all new sanitary sewerage systems or treatment works with a discharge or potential discharge near drinking water intakes, into shellfish growing waters, in close proximity to areas used for water contact recreation or in dense residential areas comply with the Class I Reliability Standards. However, existing facilities which were installed prior to adoption of the state regulation are not covered.

Local governments and the Hampton Roads Sanitation District have had an ongoing program to accomplish this recommendation for a number of years. Efforts to meet the Class I Reliability Standards are continuing through constant upgrading of existing facilities. At its March 1989 Commission Meeting, HRSD established a Systems Reliability Division, charged with improving overall HRSD system reliability. Division staff will be responsible for routine inspection and maintenance of the District's interceptors and pump stations.

PMR #21 *Proposed new point source dischargers should be evaluated for consistency with water quality goals and standards and should not be permitted to result in a net increase of pollutant loadings to the River.*

When the CERWQMP: PMR was being prepared, it was believed that additional analysis of the relative contributions and impacts of point and nonpoint source pollution required further analysis. It was also believed that the Elizabeth River receiving water quality model should be upgraded and used in this analysis and in the evaluation of future dischargers. That belief remains valid. Absent improvement to and use of this model, it is obvious that proposed point sources must be evaluated for their consistency with existing goals and standards and that water quality degradation should not result from any new dischargers to the River.

The SWCB evaluates all proposed point source discharges for consistency with the State Water Quality Standards and State Water Control Board Regulations. That evaluation includes an opportunity for local governments and regional agencies to comment on the consistency of the proposed discharge with local and regional plans.

PMR #22 *Public sewerage facilities should be extended to all feasible parts of the basin.*

Again, local governments and the HRSD have been pursuing this objective for a number of years. Virtually all areas of the Basin, which are presently developed, are served by public wastewater facilities. As development occurs, sewerage service extension is accomplished on a cooperative basis by the public and private sectors.

PMR #23 *The HRWQA/VIMS receiving water model for the Elizabeth river should be upgraded and applied once the VIP has been completed and operational for five years and/or when sufficient data has been collected via the Old Dominion University nonpoint source sampling and testing program to warrant a reexamination of the point source/nonpoint source relative contribution level. In the case of the latter, this should be done only if the STORM model (or equivalent) is similarly upgraded to reflect modelling technology improvements and increased data availability since the mid-1970s.*

No action has been taken on this recommendation, since the VIP is not yet complete. The recommendation remains valid. Refer also to comments on PMR #21.

PMR #24 *The HRSD, local jurisdictions and the U.S. Department of Defense should continue present efforts to eliminate infiltration and inflow to the public sewerage collection system.*

Again, the localities, HRSD and the Department of Defense have an ongoing program to reduce and eliminate infiltration and inflow to the sewerage collection and transmission system. HRSD has developed a computer model of its Interceptor system, including pump stations and tributary local collection systems. The system model is used to analyze the performance of the overall HRSD system as well as components of that system. This analysis is necessary to define the magnitude of I/I problems and to set correction priorities, It is expected that this program will remain an ongoing program. It will be reinforced by the activities of the new HRSD System Reliability Division.

PMR #25 *The biological impacts of the elevated metals and organics noted earlier in the report must be assessed. Additionally, the relative contribution of point and nonpoint sources for those substances must be determined and, subsequently, NPDES permit discharge limits should be*

established for those point source discharges which are significant contributors.

Through its Elizabeth River Restoration Strategy, the SWCB is pursuing this recommendation. Preliminary efforts in this regard were accomplished during 1987 and 1988 through a contract with Old Dominion University. Results of that effort are discussed later in Appendix G.

The SWCB has adopted a Toxics Management Program to address the specific concern of point source toxic substance discharges.[10] This program is designed to assure that toxics are not present in toxic amounts in surface waters. It requires that prior to issuance of an NPDES (VPDES) permit, the need for toxics management must be determined through biological and chemical monitoring. If it is determined that toxic substances are present in toxic amounts, a toxic reduction program must be instituted. At present, this program applies to most heavy manufacturers in Standard Industrial Classification Codes 21-39, to any industry with a discharge in excess of 50,000 gallons per day irrespective of its SIC, to Publicly Owned Treatment Works with discharge greater than 1,000,000 gallons per day or having a pretreatment program, as well as any other discharge with demonstrated or suspected toxic pollutants in its discharge.

PMR #26 *The "Triennial Review" process followed by the State in establishing and revising water quality standards should be annualized and a priority list of pollutants or classes of pollutants to be evaluated within a set time period should be established. Such a priority list should be developed with input from the potentially affected dischargers as well as the public at large.*

This recommendation has not been adopted. However, the SWCB indicates that it has adopted a "Constant Review" process. At the present time, the SWCB is developing standards for all parameters for which EPA has developed criteria. Generally, the criteria, if numerical and sufficiently documented, will be adopted directly as standards. The EPA listing of 126 priority pollutants is being considered initially in this process. Also, the SWCB is examining its Toxics Data Base for the Elizabeth River to identify critical non-priority pollutants, which merit standards at this time.

PMR #27 *The SWCB Pilot Toxics Strategy Initiative includes "fingerprinting" the effluents of ten dischargers to the Elizabeth. This effort should be expanded to include more dischargers and runoff from industrial sites. Currently, the project is funded as part of Virginia's Chesapeake Bay*

Initiatives. More stable long term funding for this should be identified.

The toxics "fingerprinting" study continued in 1987-88. Effluent and sediment samples were taken from thirty (30) point source discharge sites in tributaries to the Chesapeake Bay. Ten of these sites were in the Elizabeth River Basin. Effluent, sediments and tissues were analyzed for the presence of toxic compounds. This program has essentially been replaced by other SWCB toxics studies.

The Toxics Program, using the SWCB's special monitoring trailer, has evaluated effluent from eight facilities in the Elizabeth River Basin. They include the Army Base and Pinners Point STPs, NORSHIPCO, Metro Machine, Colonna's Shipyard, Norfolk Naval Shipyard, Craney Island Fuel Depot and Marpol, Inc. Additional tests are now being conducted at the Navy Sewells Point Complex. The Toxics Program includes both acute and chronic testing of biological effects and chemical evaluation. During these on-site testing programs, between twenty (20) and thirty (30) ambient sites have also been evaluated. Because of the success of this program, the SWCB has acquired an additional toxics trailer in order to expand the program statewide.

A special study of selected point source discharges is being conducted by the SWCB to determine the presence and nature of bioaccumulative compounds.

Finally, while not directly related to the toxics "fingerprinting" study, the SWCB has instituted a special study of discharges from oil/water separators. This study is examining oil/water separator influent characteristics, effluent quality and system design. It is based on the results of previous studies which indicate that oil/water separator discharges may be extremely toxic due to the presence of a variety of toxic organics and heavy metals.

PMR #28 *In implementing a more rigorous management program for the Elizabeth River, the symbiotic relationship of water quality and land use management with other resource management programs should be recognized. These include coastal resources, air quality and solid and hazardous waste management. Implementation efforts should be closely coordinated among these programs in order to maximize the potential mutual benefits.*

Given the somewhat obvious nature of this recommendation, it is difficult to cite specific examples of such symbiotic efforts. However, several ongoing efforts which implicitly recognize this can be cited. They include this special watershed assistance project, local and regional public education programs and local and regional programs in hazardous waste management and recycling.

PMR #29 *For potential development sites with a known or suspected history of having been a hazardous waste or toxic material disposal area, test borings with attendant chemical analyses to determine the presence or absence of such materials should be conducted.*

At the present time, no local or state requirements to accomplish this recommendation have been developed. However, the private sector has proceeded with evaluations of the potential presence of hazardous waste on development sites throughout the Basin. These programs have been instituted at the insistence of the banking industry to protect itself as well as prospective developers from liability under the federal Superfund Program. Developers and/or purchasers of commercial and industrial property have been required to certify that sites are not included on any state or federal cleanup list. Many have also been required to certify that no hazardous materials are present on the site. This latter requirement has been accomplished through review of historical aerial photographs, tax maps and other local land use information. In many cases, field tests, including soil borings, have also been carried out.

Both the U.S. Geological Survey and the U.S. Environmental Protection Agency have identified sites in the Elizabeth River Basin, which may have been used in the past for hazardous waste disposal and related activities. USGS efforts have focussed on incorporating EPA-generated information in a computerized Geographic Information System. The EPA efforts have included the Elizabeth River Basin as one element in a study of hazardous material use and waste disposal throughout metropolitan South Shore Hampton Roads. Basin local governments through the SVPDC contributed extensive historic land use data to the EPA study. That effort is discussed in more detail in Appendix G.

PMR #30 *Because of the interjurisdictional impacts associated with many developments along the river, local governments should provide for advisory review of major development proposals by neighboring localities. This could be accomplished directly among the jurisdictions or through the HRWQA/SVPDC.*

This recommendation has not been implemented. It is being evaluated further through this project.

PMR #31 *The State (Virginia Institute of Marine Science) should update and publish the Tidal Wetlands Inventories for the basin.*

The Tidal Wetlands Inventory for the City of Norfolk has been completed and published. Inventories for the Cities of Chesapeake and Portsmouth are still in the development process. Raw data for the Portsmouth Inventory was used in developing the Shoreline Element of the Portsmouth Comprehensive Plan. The SVPDC proposed to undertake a special aerial photography study of wetlands throughout the Region, including the Elizabeth River Basin during 1988-89. That study would have produced an aerial photograph inventory of all tidal wetlands to supplement the mapped and text inventories being prepared by VIMS. However, it has not been funded.

PMR #32 *Local wetlands boards and the Virginia Marine Resources Commission should rigorously apply the Wetlands, Sand Dunes and Subaqueous Lands Guidelines which have been developed by the VMRC and VIMS. These guidelines should be publicized and should serve as the basis for public education efforts.*

The VIMS/VMRC Guidelines are being applied by local Boards and the VMRC. The City of Portsmouth has established a Wetlands Board and has adopted the Wetlands Ordinance. In its Comprehensive Plan Statement of Policies, the City of Chesapeake has indicated its intent to rigorously pursue protection of both tidal and nontidal wetlands. The SVPDC has prepared The Value of Wetlands: A Guide for Citizens, as a means of further educating the public about the values of wetlands and techniques for protecting them. Several other public agencies and private organizations have completed guides to wetlands and other related resources. Consideration by the Virginia General Assembly of legislation to protect nontidal wetlands has also resulted in considerable publicity about the value of wetlands and the need to protect them.

PMR #33 *Through their site plan and other development reviews, local jurisdictions should ensure that public access, both physical and visual, to the Elizabeth River and its tributaries is provided and/or maintained. Where warranted, such access should be provided through public acquisition of specific parcels or of easements on specific parcels.*

Requirements for providing public access to the River have not been included in any local Zoning, Subdivision or Site Plan Review Ordinances. Specific projects to provide additional public access are being undertaken by the individual cities. They include development of a public park at the old Lamberts Point Landfill and renovation of an old boat ramp on the Eastern Branch by the City of Norfolk and development of a new boat ramp at the Jordan Bridge by the City of Chesapeake.

The City of Portsmouth addressed the question of additional public access in the Shoreline Element of its Comprehensive Plan, although specific implementation steps have not yet been taken. Also, the City of Chesapeake is addressing this issue in its Comprehensive Plan. Because additional public access opportunities are extremely limited in the Virginia Beach portion of the Basin, no actions have been taken by that city. However, Virginia Beach has examined opportunities and developed additional access facilities in other water bodies in the city.

The SVPDC has completed The Waters of Southeastern Virginia recommending specific projects, including development of several waterway trails, to increase public access to the River. Finally, the Public Access Strategy component of the 1987 Chesapeake Bay Agreement should result in improved access to the Elizabeth River and other tributaries to the Chesapeake Bay.[11]

PMR #34 *Local governments and waterfront property owners should ensure that the river and its shoreline are maintained in a state of cleanliness in order to maintain the viability of these aesthetic resources for the enjoyment of the citizens. In support of this, local governments should support the Corps of Engineers project to remove drift material and the sources of such material from the Hampton Roads Harbor. Implementation funding for this program is included in the federal Water Resource Development Act of 1986.*

Each of the Basin's communities undertake projects to remove derelict vessels and structures from the shoreline as elements of other redevelopment projects. The City of Chesapeake has been aggressively pursuing funding to undertake a comprehensive evaluation of derelict vessels and structures as the first step in an effort to revitalize and develop its waterfront. No funding has been obtained at this point. The Corps of Engineers' project to remove sources of harbor drift from throughout the Port of Hampton Roads has been authorized. However, no funds have been appropriated for this project.

The CERWQMP: PMR also recommended that a number of additional studies be undertaken to assist in finalizing action recommendations. They included additional nonpoint source monitoring, especially for toxics; evaluation of BMP effectiveness and further development of design criteria; site- specific analyses of heavy industry related nonpoint source pollution; and, identification of potential sources of hazardous and toxic pollutants associated with past disposal practices.

As mentioned earlier, the SWCB contracted with Old Dominion University to sample potential sources of nonpoint toxic pollution to the River. That study has been completed and is being used by the State Water Control Board in devising a

comprehensive water quality monitoring program for the River. Basin localities are working with the HRWQA and the SVPDC to develop a comprehensive water quality sampling program for the entire region, including the Elizabeth River, to fulfill the requirements of the U.S. Environmental Protection Agency Stormwater Permitting Program.

As can be seen from the preceding paragraphs, action has been taken on many of the Preliminary Management Recommendations made in the CERWQMP: PMR. If specific implementation activities have not occurred, continuing studies or legislation related to the recommended action are laying the groundwork for future implementation. No attempt is made to attribute all of these successful implementation activities to the CERWQMP: PMR, since many of them have resulted from parallel programs and initiatives by state, federal and local agencies. Together, these ongoing programs establish the framework which will guide local, state and federal actions for the foreseeable future.

ENDNOTES

[1]City of Virginia Beach, Development Ordinance Revisions, Including Stormwater Management Ordinance and Subdivision Ordinance: City of Virginia Beach (Virginia Beach: The City, 1988).

[2]Woolpert Consultants, Coastal Zone Management Plan: City of Portsmouth, Virginia (Portsmouth, Virginia: The City, 1988).

[3]City of Chesapeake, Basic Policies for the Comprehensive Plan of Chesapeake, Virginia (Chesapeake, Virginia: The City, 1988).

[4]Chesapeake Bay Preservation Act, Chapter 608 Acts of Assembly 1988, Title 10, Chapter 25, Code of Virginia, 1950, as amended.

[5]Virginia State Water Control Board, "Tributyltin in Surface Waters." Regulation VR680-21-01.13.

[6]U.S. Environmental Protection Agency, "Tributyltin Antifoulants; Notice of Intent to Cancel; Denial of Applications for Registration; Partial Conclusion of Special Review" at 53 Federal Register 39022, October 4, 1988.

[7]SVPDC, The Value of Wetlands: A Guide for Citizens, (Chesapeake, Virginia: SVPDC, 1988).

[8]State Water Control Board, "Nutrient Enriched Waters," VR680-21-07.3.

[9]State Water Control Board, "Policy for Nutrient Enriched Waters," VR680-14-02.

[10]State Water Control Board, "Toxics Management Regulation," VR680-14-03.

[11]See for example Public Access Task Force Committee, Chesapeake Bay and Susquehanna River Public Access Guide (Richmond, Virginia: Commonwealth of Virginia, 1989).

APPENDIX B

COMPATIBILITY ANALYSIS

WATER QUALITY AND LAND USE DEVELOPMENT

GOALS AND OBJECTIVES

The question of appropriate water quality goals for the Elizabeth River has permeated discussions of water quality management approaches and plans for years. In the report, Background and Problem Assessment Report for the Elizabeth River, the State Water Control Board, Hampton Roads Water Quality Agency and Southeastern Virginia Planning District Commission identified this issue as central to developing a water quality management plan for the River. It was believed that desired uses of the River should determine the goals to be achieved. In turn, specific management approaches and decisions were thought to depend on the desired water quality goal. Obviously, cleanup and long-term management costs would reflect the selected goal(s). If a high level of water quality was the goal, the costs of achieving and maintaining that level would likewise be relatively high. If a lesser goal was established, lower costs would be incurred.

Closely related to the question of appropriate water quality goals for the River is the question of compatibility between those goals and desired land use development goals. Compatibility between waterfront land uses was also identified as a critical concern in the development of a comprehensive water quality management plan for the River. Based on the belief that these issues must be addressed early in the planning process, the three agencies agreed to pursue a consensus building approach in the determination of water quality goals and objectives, land use development goals and objectives and the compatibility between them.

RIVER USE/CHARACTER GOALS

In preparing the Comprehensive Elizabeth River Water Quality Management Plan: Preliminary Management Recommendations (CERWQMP: PMR), the HRWQA worked closely with River User Group Task Forces, comprised of representatives of the variety of interest groups concerned with the River. They included representatives of the basin's local governments, state and federal agencies, research institutions, industry, business and citizen groups. These groups were surveyed to determine critical issues and basin goals, reflecting the interests of each group. Technical scopes of work (Problem Agendas) to determine the management approach to dealing with each of these issues were developed. This effort served as the basis for the preliminary management recommendations described in CERWQMP: PMR.

Through the River User Group process, basic water quality and land use goals for the Elizabeth River Basin were established. They were as follows:

- To maintain the usage of the river system as an "industrial and commercial highway".
- To maintain the aesthetic quality of the river system for enjoyment of users.

- To improve and maintain water quality at a level which does not threaten the health of living resources (human and non-human) using the river system.

- To prevent river system use activities from adversely impacting the environment in adjacent waterways and areas.

- To encourage waterfront land use activities and decisions compatible with the other goals.[1]

It should be noted that the preceding goals statements reflect the considerable discussion of these goals that occurred following completion of the CERWQMP: PMR.

Of the five primary issue areas identified during the planning process, two were addressed in detail in the CERWQMP: PMR. They were:

- Nonpoint Source Management.

- Waterfront Development.

In developing management approaches addressing these two issues that would help to achieve the water quality goals, the following objectives were established:

- To maintain conditions conducive to the economic viability of land uses dependent on waterfront locations, recognizing the importance of the Elizabeth River as an industrial and commercial highway.

- To achieve a pollution control program which comprehensively addresses the multiple (point and nonpoint) source contributors to poor water quality conditions.[2]

- To protect critical aquatic resource areas from impacts typically associated with land development and conversion.

- To promote continued aesthetic attractiveness of the Elizabeth River.

- To provide reasonable pollution control options to local development review authorities and the private sector for potential development activities within the watershed.[3]

Preliminary management recommendations, which would permit the achievement of these objectives, were developed.

WATER QUALITY GOALS

Federal and state laws have established water quality goals for all waterbodies, including the Elizabeth River and its tributaries. Without question, the overall state and federal water quality goal is that all waterbodies be "fishable/swimmable". Section 101 of the Clean Water Act, as amended, states this national water quality goal more specifically as:

> Restore and maintain the chemical, physical and biological integrity of the Nation's waters, by:
>
> - eliminating the discharge of pollutants to navigable waters by 1985;
>
> - wherever attainable, providing for the protection and propagation of fish, shellfish, and wildlife and providing for recreation in and on the water, by 1983; and,
>
> - prohibiting the discharge of toxic pollutants in toxic amounts.[4]

Where current water quality conditions do not satisfy the "fishable/swimmable" goal, they are to be "restored and maintained". Those water bodies that do meet the overall goal are to be "maintained" at that level through the application of an antidegradation standard.

To ensure that this goal was met in a timely fashion, the federal law established a series of deadlines for achieving specified levels of wastewater treatment and instream water quality. Resource constraints and technological impediments have caused the federal government to postpone many of the deadlines originally established in the Water Pollution Control Act Amendments of 1972. However, the "fishable/swimmable" goal remains the goal of federal water quality management efforts.

Virginia's water quality goals are established by the State Water Control Law (Sec.62.1-44.2, et. seq., Code of Virginia, 1950, as amended). The basic state water quality goal is to "protect existing high quality State waters and restore all other State waters to such condition of quality that any such waters will permit all reasonable public uses and will support the propagation and growth of all aquatic life, including game fish which might reasonably be expected to inhabit them."[5] This goal has been generally interpreted to be identical to the federal "fishable/swimmable" goal. Through its water quality standards, the state also enforces maintenance of existing water quality through the anti-degradation policy.

The Elizabeth River Watershed is a significant component of the Chesapeake Bay Basin. In 1987, the Chesapeake Bay Agreement was executed by the Governors

of Maryland, Pennsylvania and Virginia, the Mayor of the District of Columbia, the Administrator of EPA Region III and the Chairman of the Chesapeake Bay Commission. That Agreement established new goals to guide the cleanup and management of the Chesapeake Bay. The new Chesapeake Bay Agreement goals are specific applications of the existing state and federal goals to the unique situation of the Chesapeake Bay and its tributaries. They constitute a framework for addressing the water quality needs of the Bay and its tributaries and must be considered as guidance to any effort to improve the Elizabeth River.

Goals established in the 1987 Chesapeake Bay Agreement include:

- Provide for the restoration and protection of the living resources, their habitats and ecological relationships.

- Reduce and control point and nonpoint sources of pollution to attain the water quality condition necessary to support the living resources of the Bay.

- Plan for and manage the adverse environmental effects of human population growth and land development in the Chesapeake Bay Watershed.

- Promote greater understanding among citizens about the Chesapeake Bay system, the problems facing it and policies and programs designed to help it and to foster individual responsibility and stewardship of the Bay's resources.

- Promote increased opportunities for public appreciation and enjoyment of the Bay and its tributaries.

- Support and enhance the present comprehensive, cooperative and coordinated approach toward management of the Chesapeake Bay system.[6]

These goals have been refined and stated in much greater specificity through the several Chesapeake Bay Strategies which have been developed over the last eighteen months. That process is continuing with the development of new strategy documents and evaluation of the success of ongoing implementation efforts. It can be expected that these goals will continue to be refined in light of those ongoing activities.

LOCAL DEVELOPMENT GOALS

The Elizabeth River Basin encompasses all or portions of four cities - Chesapeake, Norfolk, Portsmouth and Virginia Beach. Each of these cities has an

adopted Comprehensive Plan. As was true in 1986, the underlying goal of each of these plans, regulations and development actions is as specified in Sections 15.1-427 and 15.1-489 of the Code of Virginia - to promote the health, safety and general welfare of the public. Generally, the Comprehensive Plan contains the city's official, adopted statement of goals for environmental quality, land use and waterfront development. Other documents contain goals statements which also must be considered. In addition, the land use regulations enacted by each of the cities contain both explicit and implicit statements of goals.

In all cases, the Comprehensive Plan and other goals statements are the products of an ongoing planning process. At the time that the CERWQMP: PMR was prepared, both Chesapeake and Portsmouth had embarked on formal Plan revisions. Norfolk was continuing to use a Plan, adopted in the late 1960s, as the basis for preparing neighborhood and function-specific elements of its Plan. Virginia Beach had completed a major Plan revision in 1985. Today, the status of comprehensive planning in the basin's localities has changed significantly. Both Chesapeake and Portsmouth have recently completed Plan revisions. Norfolk and Virginia Beach have embarked on major updates to their Comprehensive Plans.

Chesapeake

The City of Chesapeake adopted a statement of Basic Policies for the Comprehensive Plan of Chesapeake, Virginia in March 1988. Concurrently, the City adopted a new future land use map. Technical studies and an implementation program to achieve these goals and objectives and the revised land use pattern are being finalized. This statement consolidates all of the City's goals and objectives into one comprehensive document. Goals and objectives are detailed for the following areas:

- Growth and Change
- Environment
- Utilities
- Transportation
- Land Use
- Community Facilities
- Historic Preservation and Urban Renewal
- Planning Units
- Implementation.

Through its statements of objectives, the City's new goals statement provides much greater specificity than did the great variety of goals statements reviewed during the CERWQMP: PMR.

Figure 1 summarizes the City's development goals and objectives as they relate to land use development, waterfront development and environmental protection. The Figure also highlights areas of potential conflict and compatibility between the City's development goals and established water quality goals.

The CERWQMP: PMR did not cite specific instances of conflict between the City's goals statements, as adopted in 1986, and water quality or river character goals. It did note that potential conflict existed between many of the waterfront and industrial development goals of all of the cities and the water quality goals.

The Chesapeake Policies Plan, adopted in 1988, represents a significant improvement in the area of goals compatibility. Areas of compatibility between water quality and river use goals, on the one hand, and land use development goals, on the other, have increased. For example, the Policies Plan includes a number of Goals, Policies and Objectives that address the questions of preservation of environmentally sensitive areas, water quality protection and provision of public access to the waterfront. No situation of obvious, unmitigatable conflict exists. However, there are many areas of potential conflict - generally between economic development and water quality goals. The severity of these areas of conflict is dependent upon the nature of the development that is ultimately proposed and the nature of the regulatory controls which are adopted.

FIGURE 1

CITY OF CHESAPEAKE

GOALS COMPATIBILITY ANALYSIS

CITY GOAL	WATER QUALITY/RIVER CHARACTER GOAL					
	To restore and/or maintain water quality in the river at a level sufficient for fishing and swimming.	To maintain the usage of the river system as an "industrial and commercial highway."	To maintain the aesthetic quality of the river system for enjoyment of users.	To improve and maintain water quality at a level which does not threaten the health of living resources (human and non-human) using the river system.	To prevent river system use activities from adversely impacting the environment in adjacent waterways and areas.	To encourage waterfront land use activities and decisions compatible with other goals.
A largely self-sufficient, affordable municipality of residential communities supported by compatible commercial, industrial and institutional development providing jobs, tax base, goods and services, and cultural opportunities for its varied residences, and respecting its natural resources and sense of place.	☒	☐	☐	☒	☒	☒
Conceptually, the basic city form should include a major activity center in the vicinity of I-64, major industrial areas along the Southern Branch of the Elizabeth River and along the Norfolk and Southern Railroad, mature urban communities between I-64 and the City of Norfolk, developing urban communities parallel to I-64, countryside communities south of the Chesapeake and Albemarle Canal in the vicinity of Great Bridge, rural or environmentally-sensitive areas in the southern and western sectors of the City all linked by transition areas.	☒	☐	☒	☒	☒	☒
The character of specific projects and improvements should be harmonious with and sensitive to the ambient environment, natural and man-made, in which they are located.	☐	☒	☐	☐	☐	☒
A balanced and healthful relationship between people and nature's life support systems.	☐	☒	☐	☐	☐	☒
Land should be treated as a finite, irreplaceable resource with both public and private value.	☐	☐	☐	☐	☐	☐
Urban and rural development alike should respect the natural topography, soils and geology of the site and area.	☐	☐	☐	☐	☐	☐
Agricultural and construction practices should mitigate soil erosion and should be subject to land disturbing permits.	☐	☐	☐	☐	☐	☐

FIGURE 1 (Continued)

CITY OF CHESAPEAKE

GOALS COMPATIBILITY ANALYSIS

CITY GOAL	WATER QUALITY/RIVER CHARACTER GOAL					
	To restore and/or maintain water quality in the river at a level sufficient for fishing and swimming.	To maintain the usage of the river system as an 'industrial and commercial highway.'	To maintain the aesthetic quality of the river system for enjoyment of users.	To improve and maintain water quality at a level which does not threaten the health of living resources (human and non-human) using the river system.	To prevent river system use activities from adversely impacting the environment in adjacent waterways and areas.	To encourage waterfront land use activities and decisions compatible with other goals.
The removal or displacement of topsoil from land should be permitted only in conformance with guidelines adopted by the City.	☐	☐	☐	☐	☐	☐
The chemical, biological and aesthetic quality of Elizabeth River tributaries, the Northwest River, all canals and other open water areas in the City should be protected and enhanced.	☐	☒	☐	☐	☐	☒
All wetlands and hardwood swamps defined by the Chesapeake Wetlands Ordinance, the Virginia State Wetlands Act, and the U.S. COE should be mapped and protected from inappropriate change or destruction, and from the adverse impacts of nearby development. Wetlands and hardwood swamps that are modified or eliminated by development for valid reasons should be replaced acre-for-acre in accordance with generally accepted management practices.	☐	▮▮	☐	☐	☐	☒
The City should coordinate its policies with the U.S. COE and the Section 404 Permit Program, with the U.S. EPA Office of Wetlands and Water, and with the VMRC and VIMS.	☐	☒	☐	☐	☐	☒
Shorelines of rivers, lakes and streams should be protected and modified only in conformance with guidelines established by the City to prohibit erosion, sedimentation and adverse visual impacts.	☐	☒	☐	☐	☐	☒
Forests and woodlands throughout the City should be mapped and preserved to the extent possible commensurate with their natural and visual quality, and should be modified or eliminated only in conformance with sound forestation practices.	☐	☒	☐	☐	☐	☒
Existing and suitable groundcover of all types should be preserved or enhanced to control erosion, minimize stormwater runoff, replenish the soil, provide wildlife habitats, and maintain the open space character of the community.	☐	☒	☐	☐	☐	☒

FIGURE 1 (Continued)

CITY OF CHESAPEAKE

GOALS COMPATIBILITY ANALYSIS

CITY GOAL	WATER QUALITY/RIVER CHARACTER GOAL					
	To restore and/or maintain water quality in the river at a level sufficient for fishing and swimming.	To maintain the usage of the river system as an 'industrial and commercial highway.'	To maintain the aesthetic quality of the river system for enjoyment of users.	To improve and maintain water quality at a level which does not threaten the health of living resources (human and non-human) using the river system.	To prevent river system use activities from adversely impacting the environment in adjacent waterways and areas.	To encourage waterfront land use activities and decisions compatible with other goals.
To the extent permitted under state law, property owners and developers should be encouraged or, under prescribed circumstances, required to preserve existing trees and vegetation, and provide appropriate landscape improvements to their property.	☐	☒	☐	☐	☐	☒
A safe, efficient, and dependable system of public and private utilities serving the basic health, sanitation and communication needs of property owners and tenants.	☐	☐	☐	☐	☐	☐
A program of water conservation techniques should be established and implemented.	☐	☐	☐	☐	☐	☐
Sewer collection systems should be maintained and provided to all existing developed, developing or underutilized urban/suburban areas for which on-site septic systems are unsuitable.	☐	☐	☐	☐	☐	☐
Private water treatment and distribution and wastewater collection and treatment systems should be discouraged.	☐	☐	☐	☐	☐	☐
Determine the need for amendments to existing standards for on-site wastewater facilities.	☐	☐	☐	☐	☐	☐
The first line of defense against adverse stormwater impact is to protect 100-year floodplains; woodlands, grasslands, and other permeable areas; and the capacity of natural waterways, drainage channels, and swales.	☐	☒	☐	☐	☐	☒
All land development practices should provide for on-site stormwater detention or retention such that runoff after development is at no greater rate than runoff prior to development.	☐	☒	☐	☐	☐	☒
In urban areas, separate stormwater sewer or drainage systems should be provided.	☐	☒	☐	☐	☐	☒

FIGURE 1 (Continued)

CITY OF CHESAPEAKE

GOALS COMPATIBILITY ANALYSIS

CITY GOAL	WATER QUALITY/RIVER CHARACTER GOAL					
	To restore and/or maintain water quality in the river at a level sufficient for fishing and swimming.	To maintain the usage of the river system as an 'industrial and commercial highway.'	To maintain the aesthetic quality of the river system for enjoyment of users.	To improve and maintain water quality a t a level which does not threaten the health of living resources (human and non-human) using the river system.	To prevent river system use activities from adversely impacting the environment in adjacent waterways and areas.	To encourage waterfront land use activities and decisions compatible with other goals.
Construction within the 100-year floodplain should either be prohibited, should provide for compensatory storage, or should be constructed in such a manner with the first floor at least one foot above the 100-year elevation so as not to interfere with the floodplain capacity.	☐	☒	☐	☐	☐	☒
The City of Chesapeake should continue to participate in the regional solid waste disposal system.	☐	☐	☐	☐	☐	☐
A cost-effective, well coordinated, safe and environmentally-sensitive system for moving people and goods to and from,through and within the City.	☒	☐	☒	☒	☒	☒
Roadways should be located and designed in a manner that will minimize noise, visual impact, air pollution, runoff and other impacts in harmony with the character of surrounding land uses and natural resources.	☐	☐	☐	☐	☐	☐
The City should cooperate with the U.S.COE and other appropriate public agencies to maintain the Southern Branch of the Elizabeth River, the Chesapeake and Albemarle Canal and the George Washington Canal for waterborne commerce and/or recreational boating.	☒	☐	☒	☒	☒	☒
The City should encourage the provision of harbor, marine, port, maintenance, and storage facilities associated with waterborne commerce and recreational boating.	☐	☐	☐	☐	☐	☐
Each land use should be located only on an appropriate site in terms of access, environmental conditions, community facilities and compatibility with its neighbors.	☐	☐	☐	☐	☐	☐
Desired land uses should be accommodated generally in accordance with anticipated market demands for each use.	☒	☒	☒	☒	☒	☒

FIGURE 1 (Continued)

CITY OF CHESAPEAKE

GOALS COMPATIBILITY ANALYSIS

CITY GOAL	WATER QUALITY/RIVER CHARACTER GOAL					
	To restore and/or maintain water quality in the river at a level sufficient for fishing and swimming.	To maintain the usage of the river system as an 'industrial and commercial highway.'	To maintain the aesthetic quality of the river system for enjoyment of users.	To improve and maintain water quality at a level which does not threaten the health of living resources (human and non-human) using the river system.	To prevent river system use activities from adversely impacting the environment in adjacent waterways and areas.	To encourage waterfront land use activities and decisions compatible with other goals.
Development patterns and trends should exhibit an orderly transition from urban uses in the northern part of the city to rural land uses in the southern part of the city along planned public sewer system corridors.	☐	☐	☐	☐	☐	☐
Special attention should be given to the reservation and improvement of industrial areas and sites having deep water potential, and the recruitment of compatible industries should be encouraged.	☒	☐	☒	☒	☒	☒
Adverse environmental impacts of certain existing waterfront industries should be eliminated or mitigated.	☐	☒	☐	☐	☐	☒
Land owners should be encouraged to redevelop abandoned or underutilized industrial sites for more suitable uses.	☒	☒	☒	☒	☒	☒
New industries not requiring waterfront property should be located in planned industrial parks.	☐	☐	☐	☐	☐	☐
Industrial land uses should be required to meet environmental performance standards appropriate to Chesapeake and the specific location, including the buffering of such uses from adjacent residential, commercial, institutional or public uses.	☐	☒	☐	☐	☐	☒
Where possible, open spaces should be arranged or connected in a linear form, in order to provide a network or system that can be traversed by foot, bicycle, automobiles or watercraft, as appropriate.	☐	☐	☐	☐	☐	☐
The preservation of open spaces should emphasize and encourage public access to waterways, wetlands and forested areas.	☐	☒	☐	☐	☐	☒

FIGURE 1 (Continued)

CITY OF CHESAPEAKE

GOALS COMPATIBILITY ANALYSIS

CITY GOAL	WATER QUALITY/RIVER CHARACTER GOAL					
	To restore and/or maintain water quality in the river at a level sufficient for fishing and swimming.	To maintain the usage of the river system as an 'industrial and commercial highway.'	To maintain the aesthetic quality of the river system for enjoyment of users.	To improve and maintain water quality at a level which does not threaten the health of living resources (human and non-human) using the river system.	To prevent river system use activities from adversely impacting the environment in adjacent waterways and areas.	To encourage waterfront land use activities and decisions compatible with other goals.
Recreational boating facilities should be expanded and improved along the Southern Branch of the Elizabeth River, along the Chesapeake and Albemarle Canal, and the North Landing River and a system of scenic canoe or rafting trail should be established along small waterways.	☒	☒	☐	☒	☒	☒
Agriculture is a basic social, economic and environmental asset and the City should encourage its survival.	☒	☒	☒	☒	☒	☒
The function of the South Norfolk/ Indian River Planning Unit is to provide a range of housing and living environments for those residents who prefer mature areas close to Downtown Norfolk and the Elizabeth River and to provide for economic development requiring access to a deep draft coastal waterway and major railroad lines.	☒	☒	☒	☒	☒	☒
Waterfronts and wetlands north of the Chesapeake and Albemarle Canal should be preserved and enhanced.	☐	☒	☐	☐	☐	☒
The function of the Sunray/ Camelot/Deep Creek area is to provide for a wide variety of industrial and commercial development in proximity to the Elizabeth River, major roadways and railroads.	☒	☐	☒	☒	☒	☒

LEGEND:

☐ COMPATIBLE

☒ POTENTIAL CONFLICT

▮▮ CONFLICT

Source: City of Chesapeake, Basic Policies for the Comprehensive Plan of Chesapeake, Virginia, 1988; SVPDC, 1989.

Norfolk

The Comprehensive Plan for the City of Norfolk was first adopted in the late 1960s. It has been revised a number of times since then, primarily through the development of neighborhood and function-specific plans. However, the overall development of the City continues to follow the direction established in the 1968 Comprehensive Plan. The City, through its Citizens Advisory Commission, has established specific City goals in a number of areas, including environmental quality.[7]

The environmental quality goals, established through the Citizens Advisory Commission process, cover the issues of air and water quality, solid and hazardous waste management, water supply, land use development and energy conservation. Of particular importance to this study are those goals and objectives related to the CAC-identified need to improve water quality in the Elizabeth and Lafayette Rivers. Together with economic development goals and objectives, those goals served as the basis for defining specific goals related to the development and management of the Elizabeth River. They are summarized in Figure 2, which also points out areas of support as well as potential conflict with water quality goals.

Since new goals have not been developed by the City of Norfolk, the analysis completed in 1986 remains valid. Except in the area of aesthetics and water quality, there are no goals statements that are unequivocally compatible. Economic development goals are generally consistent with the "industrial and commercial highway" goals. However, they are also potentially in conflict with environmental quality goals. Remaining development goals continue to exhibit, at least, the potential for conflict. This situation is unavoidable, due to the nature of the goals. It appears that potential conflicts can be mitigated through the use of appropriate management techniques.

The City of Norfolk has begun a formal review and revision of its Comprehensive Plan. This revision will reflect the intensive goals development effort noted above and will incorporate the requirements and guidelines of the Chesapeake Bay Preservation Act. At present, the City anticipates that this process will be completed in 1990.

FIGURE 2

CITY OF NORFOLK

GOALS COMPATIBILITY ANALYSIS

CITY GOAL	WATER QUALITY/RIVER CHARACTER GOAL					
	To restore and/or maintain water quality in the river at a level sufficient for fishing and swimming.	To maintain the usage of the river system as an 'industrial and commercial highway.'	To maintain the aesthetic quality of the river system for enjoyment of users.	To improve and maintain water quality at a level which does not threaten the health of living resources (human and non-human) using the river system.	To prevent river system use activities from adversely impacting the environment in adjacent waterways and areas.	To encourage waterfront land use activities and decisions compatible with other goals.
Encourage the development of Norfolk's water-related recreational assets and opportunities.	☒	☒	☐	☒	☒	☒
Provide opportunities for dock and marina development at appropriate locations.	☒	☒	☐	☒	☒	☒
Facilitate the development of recreational and educational uses of the waterfront.	☐	☒	☐	☐	☐	☐
Provide adequate public space for special events such as Harborfest. This includes supporting utilities at dockside for visiting ships as well as landside open space and facilities.	☒	☒	☐	☒	☒	☒
Increase and improve public access to the water's edge.	☒	☒	☐	☒	☒	☒
Develop the port for maximum economic advantage.	☒	☐	☒	☒	☒	☒
Continue capital investment in the Hampton Roads port, particularly Norfolk International Terminals, to maintain port growth and competitive advantage.	☒	☐	☒	☒	☒	☒
Provide opportunities for the location of international company plants and branch offices that are strongly linked to port development.	☒	☐	☒	☒	☒	☒
Increase suitable pier handling and storage facilities for semi-bulk cargoes needing refrigerated storage.	☒	☐	☒	☒	☒	☒
Develop long-term expansion room for port land and backup space through recycled waterfront uses or government surplus land.	☒	☐	☒	☒	☒	☒
Support regional development of the ports.	☒	☐	☒	☒	☒	☒

FIGURE 2 (Continued)

CITY OF NORFOLK

GOALS COMPATIBILITY ANALYSIS

CITY GOAL	WATER QUALITY/RIVER CHARACTER GOAL					
	To restore and/or maintain water quality in the river at a level sufficient for fishing and swimming.	To maintain the usage of the river system as an 'industrial and commercial highway.'	To maintain the aesthetic quality of the river system for enjoyment of users.	To improve and maintain water quality at a level which does not threaten the health of living resources (human and non-human) using the river system.	To prevent river system use activities from adversely impacting the environment in adjacent waterways and areas.	To encourage waterfront land use activities and decisions compatible with other goals.
Support non-port water-related development.	☒	☒	☒	☒	☒	☒
Encourage the attainment of environmental and regulatory conditions supportive of the seafood industry.	☐	▮▮	☐	☐	☐	☒
Encourage high intensity development in selected portions of the waterfront area where it is possible to capitalize on market demand for unique features of the sites.	☒	☒	☐	☒	☒	☒
Examine and define the role of water-based transportation services.	☒	☐	☒	☒	☒	☒
Maintain and enhance important water views and vistas.	☐	☐	☐	☐	☐	☐
Retain and enhance water vistas from existing and proposed streets and points of public access.	☐	☐	☐	☐	☐	☐
Maintain and improve existing pedestrian views. Add viewpoints to new development.	☐	☒	☐	☐	☐	☒
Protect water views from within the Downtown core in the design, spacing and orientation of buildings in new waterfront development.	☐	☐	☐	☐	☐	☐
Ensure a greater degree of harmony and compatibility between man's activities and the natural environment.	☐	☒	☐	☐	☐	☒
Minimize the potential for damage to beaches and waterfront properties from storms and natural shoreline processes.	☒	☐	☒	☒	☒	☒
Ensure the attainment and maintenance of water quality levels necessary for health and desirable water-related recreation and other activities in the city's rivers, reservoirs and bays.	☐	☒	☐	☐	☐	☒

FIGURE 2 (Continued)

CITY OF NORFOLK

GOALS COMPATIBILITY ANALYSIS

CITY GOAL	WATER QUALITY/RIVER CHARACTER GOAL					
	To restore and/or maintain water quality in the river at a level sufficient for fishing and swimming.	To maintain the usage of the river system as an 'industrial and commercial highway.'	To maintain the aesthetic quality of the river system for enjoyment of users.	To improve and maintain water quality at a level which does not threaten the health of living resources (human and non-human) using the river system.	To prevent river system use activities from adversely impacting the environment in adjacent waterways and areas.	To encourage waterfront land use activities and decisions compatible with other goals.
Develop public awareness of and appreciation for Norfolk's unique natural and man-made assets. Upgrade community pride in these assets.	☐	☐	☐	☐	☐	☐
Mitigate environmental constraints to economic development and other desirable activities while assuring protection of the environment.	☒	☒	☐	☐	☒	☒
Assist prospective and expanding industries and development with procedural and technical requirements of environmental regulations.	☒	☐	☒	☒	☒	☒
Intensify environmentally acceptable efforts to reduce the negative effects of certain plant and animal species on the community.	☒	☐	☒	☒	☒	☒
Improve environmental safety.	☐	☒	☐	☐	☐	☒
Seek greater local inclusion in regional, State and Federal coordination activities in the management of hazardous and nuclear wastes.	☐	☐	☐	☐	☐	☐
Support efforts to maintain and improve environmental quality.	☐	☒	☐	☐	☐	☒
Increase awareness of the proper use and handling of household and other everyday materials, substances and practices which pose a threat to the environment.	☐	☐	☐	☐	☐	☐
Intensify efforts and support for the development of regional disposal sites for solid, hazardous and nuclear wastes.	☐	☐	☐	☐	☐	☐
Support the maintenance and improvement of regional, state, and federal water quality management efforts.	☐	☒	☐	☐	☐	☒

FIGURE 2 (Continued)

CITY OF NORFOLK

GOALS COMPATIBILITY ANALYSIS

CITY GOAL	WATER QUALITY/RIVER CHARACTER GOAL					
	To restore and/or maintain water quality in the river at a level sufficient for fishing and swimming.	To maintain the usage of the river system as an 'industrial and commercial highway.'	To maintain the aesthetic quality of the river system for enjoyment of users.	To improve and maintain water quality at a level which does not threaten the health of living resources (human and non-human) using the river system.	To prevent river system use activities from adversely impacting the environment in adjacent waterways and areas.	To encourage waterfront land use activities and decisions compatible with other goals.
Encourage the maintenance and further development of viable solid and hazardous waste recycling activities.	☐	☐	☐	☐	☐	☐
Ensure that economic development and transportation improvements take into account the need for improved levels of air quality and reductions in energy consumption. (Assuming this statement was intended to include water quality.)	☐	☒	☐	☐	☐	☒
Minimize the negative effects of energy conservation measures and alternative energy resources on air and water quality.	☐	☐	☐	☐	☐	☐
Preserve and reintroduce desirable natural features and plant and animal species throughout the city.	☐	☒	☐	☐	☐	☒
Increase sensitivity to the environment and awareness of environmental programs.	☐	☐	☐	☐	☐	☐
Improve community knowledge about the local environment.	☐	☐	☐	☐	☐	☐

LEGEND:

☐ COMPATIBLE

☒ POTENTIAL CONFLICT

▮▮ CONFLICT

Source: City of Norfolk,Department of City Planning to HRWQA Goals, Objectives and Policies Task Force, 1986; City of Norfolk Citizens Advisory Commission, Community Environment, 1983; and SVPDC, 1989.

Portsmouth

The City of Portsmouth completed a thorough revision of its Comprehensive Plan in late 1988. This Plan has undergone extensive citizen review over the last several months. Its adoption is now being considered formally. The City's new Comprehensive Plan consists of two volumes: a statement of goals and objectives and strategies to achieve them, and a technical report documenting the studies and analyses which were the bases for the goals, objectives and strategies outlined in the first volume.[8] Specific statements of goals and objectives are included in the following areas:

- Transportation
- Land Use
- Parks and Open Space
- Community Facilities
- Image and Appearance
- Tax Base and Jobs
- The Natural Environment.

The revised Plan is written and organized as a working tool for staff and decision-makers and as an educational document for the public.

The Portsmouth Comprehensive Plan includes an extensive discussion of strategies for improving and managing the City's environment. Recommended strategies include:

- Protection of tidal wetlands and other environmentally sensitive areas.
- Improvement of surface water quality in the Elizabeth River and its tributaries.
- Use of "Transfer of Development Rights" to preserve environmentally sensitive areas.
- Compliance with the Chesapeake Bay Preservation Act.
- Preservation of trees and the planting of new vegetation.

- Review of borrow pit proposals to ensure adequate protection of water quality.[9]

This statement is based on a companion study - Coastal Zone Management Plan: City of Portsmouth, Virginia, which was prepared concurrently. This document addresses many of the recommended actions contained in the CERWQMP: PMR and establishes water quality management and protection as a City goal.

Plan goals and objectives as they relate to land use and waterfront development and environmental quality are summarized in Figure 3. Their compatibility with water quality goals is identified. There are no instances of complete conflict between Portsmouth's development goals and water quality goals. Also, there are relatively few situations where the two sets of goals are totally compatible. There are many instances of potential goals conflict, most of which can be managed through the use of appropriate management techniques.

FIGURE 3
CITY OF PORTSMOUTH
GOALS COMPATIBILITY ANALYSIS

CITY GOAL	WATER QUALITY/RIVER CHARACTER GOAL					
	To restore and/or maintain water quality in the river at a level sufficient for fishing and swimming.	To maintain the usage of the river system as an 'industrial and commercial highway.'	To maintain the aesthetic quality of the river system for enjoyment of users.	To improve and maintain water quality at a level which does not threaten the health of living resources (human and non-human) using the river system.	To prevent river system use activities from adversely impacting the environment in adjacent waterways and areas.	To encourage waterfront land use activities and decisions compatible with other goals.
Improve transportation locally and regionally.	☒	☐	☒	☒	☒	☒
Ferry transportation is an important component of the transportation system.	☒	☒	☒	☒	☒	☒
Develop an orderly and efficient land use pattern.	☒	☒	☒	☒	☒	☒
Make the best use of limited land resources.	☒	☒	☒	☒	☒	☒
Provide for conveniently located recreational, educational, public and commercial services.	☒	☒	☒	☒	☒	☒
Prevent creation of new commercial strips.	☒	☐	☐	☒	☒	☒
Use zoning more effectively to promote compatibility.	☐	☐	☐	☐	☐	☐
Improve the quality and variety of housing.	☒	☐	☐	☒	☒	☒
Conserve neighborhoods and architectural heritage.	☐	☐	☐	☐	☐	☐
Protect residential areas from adverse impacts of incompatible land uses and negative environmental factors.	☐	☒	☐	☐	☐	☐
Provide landscaped buffers between potentially incompatible land uses.	☐	☒	☐	☐	☐	☐
Locate new multi-family development in a variety of areas including waterfront sites with adequate traffic and utility capacity.	☒	☒	☒	☒	☒	☒

FIGURE 3 (Continued)

CITY OF PORTSMOUTH

GOALS COMPATIBILITY ANALYSIS

CITY GOAL	WATER QUALITY/RIVER CHARACTER GOAL					
	To restore and/or maintain water quality in the river at a level sufficient for fishing and swimming.	To maintain the usage of the river system as an 'industrial and commercial highway.'	To maintain the aesthetic quality of the river system for enjoyment of users.	To improve and maintain water quality at a level which does not threaten the health of living resources (human and non-human) using the river system.	To prevent river system use activities from adversely impacting the environment in adjacent waterways and areas.	To encourage waterfront land use activities and decisions compatible with other goals.
Long-term development of Craney Island should focus on economic development and recreation projects.	☒	☒	☒	☒	☒	☒
Special consideration will be given to protecting environmentally sensitive areas from new adverse impacts of new industrial developments and employment centers.	☐	☒	☐	☐	☐	☒
Impacts on wetlands, tidal flats, public access to and views from the shoreline should be considered in designing activities on waterfront sites.	☐	☒	☐	☐	☐	☒
Improve the availability of parks and open spaces.	☒	☒	☐	☒	☒	☒
Increase park system acreage.	☐	☒	☐	☐	☐	☒
Increase pubic access to the shoreline.	☒	☒	☐	☒	☒	☒
Improve geographic distribution of park sites.	☐	☒	☐	☐	☐	☒
Pursue reuse and joint-use concepts.	☒	☒	☒	☒	☒	☒
Cluster residential development and PUDs shall be encouraged as a means of preserving open space.	☐	☐	☐	☐	☐	☐
Open space corridors shall be considered as a means of protecting sensitive environmental areas such as wetlands.	☐	☒	☐	☐	☐	☒
Dedication of land for parks and open space shall be encouraged.	☐	☐	☐	☐	☐	☐

FIGURE 3 (Continued)

CITY OF PORTSMOUTH

GOALS COMPATIBILITY ANALYSIS

CITY GOAL	WATER QUALITY/RIVER CHARACTER GOAL					
	To restore and/or maintain water quality in the river at a level sufficient for fishing and swimming.	To maintain the usage of the river system as an 'industrial and commercial highway.'	To maintain the aesthetic quality of the river system for enjoyment of users.	To improve and maintain water quality at a level which does not threaten the health of living resources (human and non-human) using the river system.	To prevent river system use activities from adversely impacting the environment in adjacent waterways and areas.	To encourage waterfront land use activities and decisions compatible with other goals.
Public access to shorelines should be protected and increased.	☒	☒	☐	☒	☒	☒
Publicly and privately owned shorelines should be kept clean.	☐	☐	☐	☐	☐	☐
Where residential development already exists along tidal creeks, negotiations should occur between the U.S. Army Corps of Engineers and affected property owners for the maintenance dredging of such creeks.	☒	☒	☒	☒	☒	☒
Improve City's image and appearance	☐	☒	☐	☐	☐	☒
Promote high quality design and landscaping in public and private sector projects.	☐	☒	☐	☐	☐	☒
Improve the appearance of high-visibility sites and corridors.	☐	☒	☐	☐	☐	☒
Continue urban renewal and priority action program projects.	☐	☒	☐	☐	☐	☒
Utilizing the City's colonial and maritime heritages as design theme should be encouraged.	☐	☐	☐	☐	☐	☐
Encourage landscaping for all new public and private developments.	☐	☒	☐	☐	☐	☒
Public views of waterfronts will be carefully protected in the approval of development proposals and street closures.	☐	☒	☐	☐	☐	☒
Expand the tax base and create new jobs.	☒	☐	☒	☒	☒	☒

FIGURE 3 (Continued)

CITY OF PORTSMOUTH

GOALS COMPATIBILITY ANALYSIS

CITY GOAL	WATER QUALITY/RIVER CHARACTER GOAL					
	To restore and/or maintain water quality in the river at a level sufficient for fishing and swimming.	To maintain the usage of the river system as an 'industrial and commercial highway.'	To maintain the aesthetic quality of the river system for enjoyment of users.	To improve and maintain water quality at a level which does not threaten the health of living resources (human and non-human) using the river system.	To prevent river system use activities from adversely impacting the environment in adjacent waterways and areas.	To encourage waterfront land use activities and decisions compatible with other goals.
Sell or lease unneeded public land for taxable development.	☒	☐	☒	☒	☒	☒
Build the public improvements needed to stimulate private development.	☒	☐	☒	☒	☒	☒
Capitalize on Portsmouth's transportation and locational advantages.	☒	☐	☒	☒	☒	☒
Diversify Portsmouth's economic base.	☒	☒	☒	☒	☒	☒
Developable commercial and industrial waterfront sites should be reserved for water-dependent or water-related uses, such as marine and maritime businesses, port activities, and tourism and commercial recreation.	☒	☐	☒	☒	☒	☒
When uses for vacant land are being considered, they should be compatible with the natural environment.	☐	☒	☐	☐	☐	☒
The economic benefit of new development should exceed the public cost.	☒	☒	☒	☒	☒	☒
The highest priority will be given to uses with the greatest net economic benefit.	☒	☒	☒	☒	☒	☒
Develop a "marine park," including recreational, commercial and light industrial boating activities on the north shore of Scotts Creek.	☒	☒	☐	☒	☒	☒
Develop a marina and waterfront luxury residential activity on the south shore of Scotts Creek.	☒	☒	☐	☒	☒	☒
Develop the Cox Property for mixed use including port facilities, light industry and commercial use, while protecting adjacent environmentally sensitive areas.	☒	☒	☒	☒	☒	☒

FIGURE 3 (Continued)

CITY OF PORTSMOUTH

GOALS COMPATIBILITY ANALYSIS

CITY GOAL	WATER QUALITY/RIVER CHARACTER GOAL					
	To restore and/or maintain water quality in the river at a level sufficient for fishing and swimming.	To maintain the usage of the river system as an 'industrial and commercial highway.'	To maintain the aesthetic quality of the river system for enjoyment of users.	To improve and maintain water quality at a level which does not threaten the health of living resources (human and non-human) using the river system.	To prevent river system use activities from adversely impacting the environment in adjacent waterways and areas.	To encourage waterfront land use activities and decisions compatible with other goals.
Develop the old Coast Guard base for water-dependent commercial or light industrial activity.	☒	☒	☒	☒	☒	☒
Use Craney Island for economic development and recreation.	☒	☒	☒	☒	☒	☒
Protect the City's natural environment.	☐	☒	☐	☐	☐	☒
Comply with the Chesapeake Bay Preservation Act.	☐	☒	☐	☐	☐	☒
Prevent inappropriate wetlands development.	☐	☒	☐	☐	☐	☒
Preserve trees, vegetation and wildlife habitats.	☐	☒	☐	☐	☐	☒
Control location of industries with negative impacts.	☐	☒	☐	☐	☐	☒

LEGEND:

☐ COMPATIBLE

☒ POTENTIAL CONFLICT

▮▮ CONFLICT

Source: City of Portsmouth, Preliminary Draft: Comprehensive Plan, 1988; SVPDC, 1989.

Virginia Beach

The most recent revision of the Virginia Beach Comprehensive Plan was completed in 1985. City goals and objectives were analyzed in great detail in the CERWQMP: PMR. Because new goals have not been developed, no new analysis has been completed. That earlier analysis indicated that the Elizabeth River had not been given detailed attention in the Comprehensive Plan due to the relatively small portion of the basin which lies in Virginia Beach and the lack of recently documented water quality problems in that portion of the basin.[10]

The City of Virginia Beach Comprehensive Plan includes a succinct statement of city development goals directed at managing growth through linkages to the provision of public facilities, including roads and utilities. Figure 4 summarizes the City's development and environmental goals as they relate to the Elizabeth River Basin. It also highlights areas of compatibility and potential conflict with water quality goals for the River. In part, because planned development in the Elizabeth River Basin is primarily residential in nature, potential conflict between the City's development goals and water quality goals is less significant than in other communities where planned development involves more intensive land uses. However, the reduction in areas of potential conflict does not translate directly into increased compatibility. Implementation of appropriate management techniques is still required to eliminate areas of potential conflict. It should be noted that Virginia Beach's goals and policies in the area of water quality protection have been reaffirmed on several occasions over the last several years. The most significant reaffirmation was the 1988 adoption of a comprehensive Stormwater Management Ordinance, requiring the use of Best Management Practices in most land development activities.[11]

The City is presently revising its Comprehensive Plan. Expected to be complete in 1990, the Virginia Beach Comprehensive Plan is to contain a more explicit statement of City environmental goals and objectives. It will also incorporate the goals and objectives of the Chesapeake Bay Preservation Act.

FIGURE 4

CITY OF VIRGINIA BEACH

GOALS COMPATIBILITY ANALYSIS

CITY GOAL	WATER QUALITY/RIVER CHARACTER GOAL					
	To restore and/or maintain water quality in the river at a level sufficient for fishing and swimming.	To maintain the usage of the river system as an 'industrial and commercial highway.'	To maintain the aesthetic quality of the river system for enjoyment of users.	To improve and maintain water quality at a level which does not threaten the health of living resources (human and non-human) using the river system.	To prevent river system use activities from adversely impacting the environment in adjacent waterways and areas.	To encourage waterfront land use activities and decisions compatible with other goals.
Plan for and accommodate the highest reasonable level of growth and change which can be served without undue delays or reduced levels of service and which are consonant with the constraints established in the City's Plan.	☒	☐	☐	☒	☒	☒
Develop and pursue plans and policies which are consistent with those of the federal and state government, including the military, by actively participating in regional planning forums where intergovernmental activities can be reviewed and coordinated.	☐	☐	☐	☐	☐	☐
Establish in advance a favorable balance of growth and fiscal impact and establish a pattern of land use which will, in the aggregate, attain that balance.	☒	☐	☒	☒	☒	☒
The location and timing of public facilities and services will be determined based upon the Comprehensive Plan in a manner which will encourage orderly growth in relation to the availability of adequate public facilities.	☒	☐	☒	☒	☒	☒
Development will be guided into areas of the City where facilities and services are presently adequate or can be made adequate within a reasonable time frame.	☐	☐	☐	☐	☐	☐
Facilities and services will only be provided which are consistent with other objectives and goals of the Comprehensive Plan.	☐	☐	☐	☐	☐	☐
Facilities and services which are currently inadequate will be systematically upgraded through capital improvement programming and there will be no growth encouraged where this cannot be done within a reasonable period of time.	☐	☐	☐	☐	☐	☐
Facility and service programs will be funded and implemented based upon a priority determined by need and consistency with the Comprehensive Plan.	☐	☐	☐	☐	☐	☐

FIGURE 4 (Continued)
CITY OF VIRGINIA BEACH
GOALS COMPATIBILITY ANALYSIS

CITY GOAL	WATER QUALITY/RIVER CHARACTER GOAL					
	To restore and/or maintain water quality in the river at a level sufficient for fishing and swimming.	To maintain the usage of the river system as an 'industrial and commercial highway.'	To maintain the aesthetic quality of the river system for enjoyment of users.	To improve and maintain water quality at a level which does not threaten the health of living resources (human and non-human) using the river system.	To prevent river system use activities from adversely impacting the environment in adjacent waterways and areas.	To encourage waterfront land use activities and decisions compatible with other goals.
Private developers are encouraged to provide a variety of housing types with innovative features through the utilization of flexible zoning techniques and diverse zoning categories. For example, planned unit development can be used to protect areas of particular historical or environmental importance.	☒	☐	☐	☒	☒	☒
Identify and protect those sites of historical and cultural importance and to specially designate them on the zoning maps.	☐	☐	☐	☐	☐	☐
Establish and enforce architectural standards in this area through the Historic Review Board to assure that historic and cultural integrity is maintained.	☐	☐	☐	☐	☐	☐
Develop and maintain a diversified economic base.	☒	☐	☒	☒	☒	☒
Industrial development is to be in accordance with an established circulation utility and drainage plan intended to minimize impact upon the City systems.	☒	☐	☒	☒	☒	☒
Separate potentially incompatible land uses by provision of visual screens or buffers.	☐	☐	☐	☐	☐	☐
Buffer large parking lots from view from the street through landscaping.	☐	☒	☐	☐	☐	☒
Encourage provision of open space through flood plain protection, planned unit development, and subdivision ordinance recreation requirements.	☐	☒	☐	☐	☐	☒
Promote and protect a high quality environment through the careful stewardship of natural resources.	☐	☒	☐	☐	☐	☒

FIGURE 4 (Continued)
CITY OF VIRGINIA BEACH
GOALS COMPATIBILITY ANALYSIS

CITY GOAL	WATER QUALITY/RIVER CHARACTER GOAL					
	To restore and/or maintain water quality in the river at a level sufficient for fishing and swimming.	To maintain the usage of the river system as an 'industrial and commercial highway.'	To maintain the aesthetic quality of the river system for enjoyment of users.	To improve and maintain water qualtiy at a level which does not threaten the health of living resources (human and non-human) using the river system.	To prevent river system use activities from adversely impacting the environment in adjacent waterways and areas.	To encourage waterfront land use activities and decisions compatible with other goals.
Existing water quality problems will be addressed by an aggressive program of reducing both point and non-point sources of pollution through requiring the use of Best Management Practices on all new development in accordance with the recommendations of the Hampton Roads Water Quality Management Plan.	☐	☒	☐	☐	☐	☒
New development will be guided into areas and configurations which avoid unnecessary impacts on important environmental resources resulting from filling, alteration or increased levels of runoff.	☐	☒	☐	☐	☐	☒
On-site retention, wherever appropriate, will be required as part of new development.	☐	☒	☐	☐	☐	☒
Development involving the 100 year flood plan as depicted on the 1984 U.S. Army Corps of Engineers Flood Insurance Rate Map will be regulated so as not to adversely affect flood storage or flood flow.	☐	☒	☐	☐	☐	☒
Provide ample open spaces to provide protection to environmentally significant areas among other purposes.	☐	☒	☐	☐	☐	☒
Manage runoff impacts and take mitigative measures.	☐	☒	☐	☐	☐	☒

LEGEND:

☐ COMPATIBLE

☒ POTENTIAL CONFLICT

▮▮ CONFLICT

Source: City of Virginia Beach, The Comprehensive Plan: Virginia Beach, 1985; SVPDC, 1989.

COMPATIBILITY ANALYSIS

At the inception of the process to develop the CERWQMP: PMR, it was believed that goals competition and conflict was a critical factor working against water quality improvement. Therefore, it appeared that a critical element in defining management needs and developing the recommended management approach would be the determination of compatibility or conflict between water quality and land use goals and objectives.

Local comprehensive plans and other goals statements were reviewed in light of the River Character/Use Goals as well as those water quality goals embodied in the federal Clean Water Act and other state and federal legislation. The goals analysis contained in the CERWQMP: PMR concluded that there were areas of potential conflict between each of the sets of goals. However, it was determined that most of the goals could be achieved simultaneously through the implementation of a variety of management programs. It was recommended that all basin localities should formally adopt water quality protection as a city goal and incorporate that goal into their comprehensive plans and development regulations.[12]

The CERWQMP: PMR goals analysis was completed approximately three years ago. As indicated in Appendix A, many of the preliminary management recommendations have been implemented to one degree or another since that time. New water quality related programs have been instituted and all local comprehensive plans have been or are being revised. In fact, at the present time, all communities either have adopted or are considering the adoption of water quality protection as a city development goal.

At the inception of the current project, it was believed that the goals analysis should be updated to reflect those ongoing activities. The preceding sections have documented the development goals of each city in the Elizabeth River Basin. The relationship between those goals and adopted state and federal water quality goals and with the River Use/Character Goals, developed during the CERWQMP: PMR process, has been determined. Three types of relationship are identified: conflict, potential conflict and compatibility.

Goals conflict occurs, when one goal is likely to result in adverse impacts on our ability to achieve another goal. For example, the goal of using the river as an "industrial and commercial highway" appears to be in general conflict with water quality goals. Achievement of the Clean Water Act goals, while also achieving this goal, appears to be unlikely given current controls on vessel discharges, use of antifoulant bottom paints, and the lack of pumpout facilities at boating and shipping facilities. This issue is exacerbated by the failure of many recreational boaters to use such facilities when they are available. Imposition of additional controls and strict enforcement of existing controls on both vessel activity and related landside activities remains necessary if we are to achieve both of these goals.

The analysis, conducted during this study, reinforces the conclusion of the CERWQMP: PMR that many waterfront development goals may potentially conflict with water quality goals. This is especially true of those local development goals calling for intensification of waterfront activities, including industrial and port-related activities, higher density residential and commercial uses and Navy goals for intensification of waterfront activities at its bases. Obviously, state goals for port development and expansion fall into this same category. In the absence of management attention and regulatory controls, these goals would likely be in direct conflict. Such conflict and associated adverse environmental impacts can be mitigated through careful planning and management of both land and river uses.

Local goals for recreational development, aesthetic enhancement, water quality improvement and protection of environmentally sensitive areas and compatibility among land uses appear to be mutually supportive of and compatible with water quality goals. However, resulting development will not necessarily be compatible simply because the goals are compatible. Management attention, on a case-by-case basis, is still required. The increased emphasis on water quality and environmental protection in local Comprehensive Plans bodes well for accomplishing this compatibility.

Local government's ability to elevate the importance of water quality protection as a City goal in the development process was enhanced by the passage of the Chesapeake Bay Preservation Act by the Virginia General Assembly in 1988. The CBPA notes that a healthy economy and a healthy Chesapeake Bay are integrally related and that economic development and water quality protection are not mutually exclusive. However, it acknowledges that careful intervention is necessary to ensure the compatibility of these potentially divergent goals.[13] To accomplish that, the CBPA established a program for managing sensitive environmental areas within the Chesapeake Bay Watershed, including the Elizabeth River Basin, and for protecting water quality in the land development process through nonpoint source pollution controls and planning for water- dependent facilities. Most importantly, it provides the legal underpinning for local efforts to manage water quality and to implement many of the recommendations of both the CERWQMP: PMR and this study.

ENDNOTES

[1]Hampton Roads Water Quality Agency, Comprehensive Elizabeth River Water Quality Management Plan: Preliminary Management Recommendations, (Norfolk, Virginia: HRWQA, 1986), pp. 29-30.

[2]Ibid, p. 32.

[3]Ibid, p. 39.

[4]Federal Water Pollution Control Act Amendments of 1972, Public Law 92-500.

[5]Virginia State Water Control Law, Title 62.1, Section 62.1-44.2, Code of Virginia, 1950, as amended.

[6]"Chesapeake Bay Agreement," December 15, 1987.

[7]City of Norfolk, Citizens Advisory Commission, Community Environment (Norfolk, Virginia: The City, 1983).

[8]The reader is referred to City of Portsmouth, Comprehensive Plan: Preliminary Draft (Portsmouth, Virginia: The City, 1988) and Comprehensive Plan: Technical Report (Portsmouth, Virginia: The City, 1988) for further information.

[9]City of Portsmouth, Comprehensive Plan: Preliminary Draft (Portsmouth, Virginia: The City, 1988), pp. 9.2 - 9.4.

[10]Southeastern Virginia Planning District Commission, Comprehensive Elizabeth River Water Quality Management Plan: Institutional Analysis and Land Use/Nonpoint Source Analysis (Norfolk, Virginia: SVPDC, 1986), p. 15.

[11]City of Virginia Beach, Development Ordinance Revisions, Including Stormwater Management Ordinance and Subdivision Ordinance: City of Virginia Beach (Virginia Beach, Virginia: The City, 1988) pp. 5 - 28.

[12]HRWQA, CERWQMP: PMR (Norfolk, Virginia: HRWQA, 1986), p. 32.

[13]Chesapeake Bay Preservation Act, Chapter 608 Acts of Assembly 1988, Title 10, Chapter 25, Code of Virginia, 1950, as amended.

APPENDIX C

ANALYSIS OF LOCAL

LAND USE DEVELOPMENT REGULATIONS

AND

INSTITUTIONAL STRUCTURE

The Comprehensive Elizabeth River Water Quality Management Plan: Preliminary Management Recommendations (CERWMP: PMR) contained an extensive review of the existing institutional structure and regulatory framework for land use and water quality management in the Elizabeth River Basin. That report identified gaps and deficiencies in the institutional structure and its ability to manage development in a manner which was compatible with water quality goals and objectives.

It is believed that, while this structure has become somewhat more complex, its ability to manage the Basin's resources in a comprehensive fashion has also improved. A number of state, local, regional and federal agencies are currently involved in resource management in the Basin. They have a variety of responsibilities - regulatory, operational, planning and property owner. While the number of state agencies involved has increased, there has been a concurrent simplification of the local institutional structure. New planning and regulatory programs addressing the Basin's resources have been instituted at all levels.

The following sections describe the current institutional structure for land use and natural resource management in the Elizabeth River Basin. They also describe the planning and regulatory programs which are being implemented by these institutions. The discussion relies heavily on its predecessor, the CERWMP: PMR.[1] That part of the institutional structure and regulatory framework, which was in place in 1986, is dealt with briefly. Emphasis is placed on those modifications that have occurred since that time. Finally, the ability of this system to address the environmental and development issues in the Elizabeth River Basin is discussed.

INSTITUTIONAL STRUCTURE

Land and water resource management, as they affect the resources of the Elizabeth River, involve a variety of federal, state, local and regional agencies. At the federal level, this includes the U.S. Environmental Protection Agency, U.S. Navy, U.S. Army Corps of Engineers and several divisions of the U.S. Departments of Agriculture, Commerce and Interior. State agencies include the Virginia Council on the Environment, Virginia State Water Control Board, Chesapeake Bay Local Assistance Department, Departments of Health, Conservation and Historic Resources (soon to be Conservation and Recreation), Waste Management and Air Pollution Control, Virginia Marine Resources Commission and Virginia Port Authority. Most local government departments have some responsibility for land use and water quality management. Regional agencies with planning, coordination and technical assistance responsibilities include the Southeastern Virginia Planning District Commission and the Hampton Roads Water Quality Agency. The Hampton Roads Sanitation District and the Southeastern Public Service Authority of Virginia have operational responsibilities. Finally, the private sector as landowners, developers, consulting engineers and resource users is intimately involved in resource development, use and management.

Previous studies conducted by and for the SVPDC and the Hampton Roads Water Quality Agency have described the responsibilities of each of these components of the water quality management institutional structure. (The reader is referred to the several HRWQA and SVPDC studies, cited in the Bibliography, for detailed documentation on the local land use and water quality management institutional structures.)[2] Based on its analyses of water quality management institutions and in conformance with the requirements of the EPA Section 208 Water Quality Management Program, the HRWQA recommended that several agencies be formally designated as having responsibility for one or more aspects of water quality management in the Hampton Roads area, including the Elizabeth River.[3] These designations are noted on Table 1. They have been accepted as a component of the regional water quality plan. Also, they have been adopted by the State Water Control Board in its water quality management plan for the Hampton Roads area.

The 1988 Session of the Virginia General Assembly enacted the Chesapeake Bay Preservation Act, establishing the Chesapeake Bay Local Assistance Board and Department.[4] The CBLA Board and Department are charged with developing Criteria for designating Chesapeake Bay Preservation Areas and for protecting water quality and other natural resources in those areas. This Board and Department did not exist when the HRWQA recommended designation of water quality management agencies for the Hampton Roads area. However, they should be considered as integral components of the institutional structure.

Several elements of the 1987 Chesapeake Bay Agreement address the issue of local involvement in the Chesapeake Bay cleanup and the need for improved land use management practices in that effort.[5] In response to the Agreement, the Chesapeake Bay Local Government Advisory Committee was established. The CBLGAC is comprised of representatives of local governments in each of the signatory states. It is charged with establishing lines of communication between the Chesapeake Bay Program and the local governments in the Basin. This effort includes providing information to local governments and soliciting input for development and refinement of program elements from them. While not having a direct role in land use and water quality management, the CBLGAC effort should facilitate local efforts in this regard.

Several initiatives have been taken to address the need for improved land use management practices in the Chesapeake Bay Basin. A Panel was established pursuant to the Chesapeake Bay Agreement to analyze development in the Basin between 1990 and 2020. The Panel's report describes a very urbanized Basin and recommends broad strategies for mitigating environmental impacts associated with that urbanization. Virginia has established a legislative study commission to review the 2020 Panel report and to develop recommendations for implementing its recommendations. The Chesapeake Bay Program has also developed guidance for use by local governments in planning and managing land use and associated environmental impacts and for identifying sources of funding for program implementation.

A number of institutional improvements have also been made at the local level. All Basin localities have given the Deputy City Manager or an equivalent position responsibility for coordinating the day-to-day activities of all city departments involved in physical development. This organizational structure facilitates development review, resolution of inter-departmental conflicts and focusses responsibility for land development and resource management. The City of Virginia Beach has gone one step further with the creation of an Office of Environmental Management with specific responsibility to ensure that environmental concerns are given adequate consideration in all development decisions. Other cities have and are considering a similar arrangement.

TABLE 1

WATER QUALITY MANAGEMENT INSTITUTIONAL STRUCTURE

POINT SOURCE MANAGEMENT DESIGNATIONS

Construction/O & M: (Includes financing)
-Major Treatment/Transmission Works
Hampton Roads Sanitation District

-Collection Systems/Connection Controls
Cities of Chesapeake, Norfolk, Portsmouth & Virginia Beach

Planning Function:
Southeastern Virginia Planning District Commission

Regional Coordination:
Hampton Roads Water Quality Agency

Regulation:
Virginia State Water Control Board
Virginia Department of Health
U.S. Environmental Protection Agency

NONPOINT SOURCE MANAGEMENT DESIGNATIONS

Construction/O & M/Technical Assistance:
Urban - Cities of Chesapeake, Norfolk, Portsmouth, Virginia Beach
Agriculture - Virginia Dare Soil and Water Conservation District

Planning Function:
Southeastern Virginia Planning District Commission

Regional Coordination:
Hampton Roads Water Quality Agency

Regulation:
Virginia State Water Control Board
Virginia Division of Soil and Water Conservation
U.S. Environmental Protection Agency

SOURCE: HRWQA, Hampton Roads Water Quality Management Plan: Plan Update 1983, pp. vi-vii.

REGULATIONS

Most of the management agencies, including all of the local entities, have adopted a wide array of regulatory and incentive measures. Historically, the most important of these for nonpoint source management have been found at the local level. They include both land use development regulations and environmental management or protection measures. Locally-adopted programs include Zoning, Subdivision Control, Erosion and Sediment Control, Wetlands and public facility design criteria, standards and guidelines. These have all been adopted pursuant to state enabling legislation and, in the case of the environmental protection measures, all have utilized the sample state ordinance. Recent local initiatives include buffering and landscaping requirements and stormwater management.

The following review of management programs is not meant to be exhaustive. Provisions of local ordinances, which are cited, are representative or, in some cases, unique requirements. They are cited as indicators of the role of water quality management in the local regulatory scheme.

Federal Programs

In 1988, the U.S. EPA proposed regulations governing the issuance of National Pollution Discharge Elimination System (NPDES) Permits for stormwater point source discharges. The CERWQMP: PMR included an extensive discussion of the status of EPA's efforts to regulate stormwater discharges. Subsequently, the Water Quality Act was passed, establishing specific requirements for permitting stormwater discharges. The following discussion highlights the proposed requirements. Appendix F to this report, as well as the companion study, Regional Stormwater Management Strategy for Southeastern Virginia, discuss the newly proposed EPA program in great detail. Ultimately, it can be expected that this will become a state program since the SWCB has been delegated most other authority under the NPDES Program.

The Water Quality Act of 1987 requires EPA to develop a stormwater regulatory program according to the following guidance:

- Regulations for industrial and municipal separate stormwater dischargers serving populations greater than 250,000 are to be issued in 1989. Permits for these dischargers must be issued or denied by February 4, 1991. Permit compliance must be achieved within three years of permit issuance.

- Regulations for municipal separate stormwater dischargers serving populations between 100,000 and 250,000 are to be issued by February 4, 1991. Decisions on permit applications are to be made by February 4, 1993. Compliance is to be attained within three years.

- Other dischargers, including communities of less than 100,000 people, will not be subject to the regulations before 1992. Prior to regulating those dischargers, EPA is to complete two major studies of these additional dischargers.[6]

Generally, stormwater permits may be issued on a system-wide or jurisdiction basis. They shall include requirements that effectively prohibit non-stormwater discharges to storm sewers. Permits shall also require controls to reduce the discharge of pollutants to the maximum extent practicable. The draft EPA regulations are presently going through the public review and comment process. It is expected that they will be promulgated in final form early in 1990. The EPA requirements will apply immediately to the Cities of Norfolk and Virginia Beach. The second phase requirements will apply to the Cities of Chesapeake and Portsmouth. Industrial dischargers in all four cities will be affected by the first set of requirements.

State Programs

There are a variety of state programs dealing with land use and environmental quality management. They include Erosion and Sediment Control, Best Management Practices Handbooks, Virginia Pollution Abatement and Pollution Discharge Elimination System Permits, Underground Storage Tanks, Wetlands, Dunes and Subaqueous Lands, Sewerage Regulations, Spill Prevention Control and Countermeasure Plans, Coastal Resources Management, Groundwater Protection and Solid and Hazardous Waste Management. Newly enacted programs include the Chesapeake Bay Preservation Act, Nonpoint Source Control Program and Stormwater Management. This latter group will assume increasing importance in the next few years.

Chesapeake Bay Preservation Act

The Chesapeake Bay Preservation Act, enacted by the 1988 Session of the Virginia General Assembly, established the Chesapeake Bay Local Assistance Board and Department. Recognizing the interrelationship between water quality, land use development and economic development, the CBPA established a cooperative state and local program to protect and improve water quality in the Chesapeake Bay and its tributaries. (Local governments outside the Chesapeake Bay Basin may opt to apply this program in other basins.) The CBPA requires that local governments incorporate water quality protection techniques into their comprehensive plans and associated regulatory measures and delineate Chesapeake Bay Preservation Areas, which are critical to protection of the quality of Virginia's waters. It also requires state agencies to act in conformance with local plans and regulations with respect to water quality protection and to provide assistance to local governments in carrying out their responsibilities.

The CBPA requires that Criteria to be used in accomplishing these activities be promulgated by July 1, 1989. Draft Regulations containing these Criteria were published in the Virginia Register on April 24, 1989. The draft Regulations would require that local governments encourage and promote:

- Protection of existing high quality state waters and restoration of all other state waters to a condition or quality that will permit all reasonable public uses and will support the propagation and growth of all aquatic life, including game fish, which might reasonably be expected to inhabit them;

- safeguarding the clean waters of the Commonwealth from pollution;

- prevention of any increase in pollution;

- reduction of existing pollution; and,

- promotion of water resource conservation in order to provide for the health, safety and welfare of the present and future citizens of the Commonwealth.[7]

These objectives are to be incorporated into local programs that include the comprehensive plan, zoning ordinance, subdivision ordinance, erosion and sediment control and building permit process. Local programs are also to provide for designation of Chesapeake Bay Preservation Areas on the zoning map and adoption of performance criteria governing development in and affecting those areas.

Chesapeake Bay Preservation Areas are comprised of two elements:

- Resource Protection Areas, including:

  - tidal wetlands;
  - nontidal wetlands hydrologically connected by surface flow and contiguous to tidal wetlands or tributary streams;
  - tidal shorelines;
  - other lands that local governments deem necessary to protect the quality of state waters; and,
  - vegetated buffer zones located adjacent to and landward of each of the other components and along both sides of tributary streams.

- Resource Management Areas, including:

  - floodplains;
  - highly erodible slopes, including steep slopes;

- highly permeable areas or other areas vulnerable to groundwater degradation;
- nontidal wetlands not included in the RPA; and,
- other lands that local governments deem necessary to prevent nonpoint source pollution of state waters.[8]

Local governments are to designate the Chesapeake Bay Preservation Areas by July 1, 1990. The full local planning and regulatory program is to be in place no later than July 1, 1991. Financial and technical assistance is to be provided to local governments by the CBLA Department.

Performance criteria to be applied to development occurring in these areas are also proposed. They include retention of vegetation, landscaping, use of best management practices, on-site sewage treatment system management, stormwater management and nontidal wetlands protection. The criteria will apply to agriculture and forestry as well as to urban development.

Stormwater Management

The Division of Soil and Water Conservation of the Department of Conservation and Historic Resources (soon to be Conservation and Recreation) has developed the Virginia Erosion and Sediment Control Handbook to implement the requirements of the "Erosion and Sediment Control Law". The law establishes a uniform statewide erosion and sediment control program to be implemented by local governments in cooperation with the Division and the local Soil and Water Conservation District. The Handbook establishes minimum criteria, standards and specifications for erosion and sediment control measures and general criteria for stormwater management. It provides basic guidance on preparing erosion and sediment control plans and for completing the design calculations.[9] Each of the four municipalities in the Elizabeth River Basin has adopted a local erosion and sediment control program in conformance with this law. Each uses the State Handbook in this program.

The Water Quality Act of 1987 established a state nonpoint source control program. The Division has been given responsibility for implementing this program. Appendix F and the companion report, Regional Stormwater Management Strategy for Southeastern Virginia, discuss this program in detail. The State's program, developed during 1988, relies on implementation of existing programs such as the Erosion and Sediment Control Program and the Best Management Practices Handbooks. It is largely voluntary in nature at the present time. As new state programs, such as the aforementioned CBPA, are developed, the State's NPS Management Program will be revised to incorporate them.[10]

The 1989 Session of the Virginia General Assembly enacted a Stormwater Management Program that should contribute greatly to our ability to manage nonpoint source pollution. Again, the Division of Soil and Water Conservation is

given responsibility for this program. This legislation authorizes local governments to establish stormwater management programs, which include:

- consistency with regulations promulgated by the state;
- provisions for long-term responsibility for and maintenance of stormwater management control devices and other techniques specified to manage the quality and quantity of runoff; and,
- provisions for the integration of locally adopted stormwater management programs with local erosion and sediment control, flood insurance, flood plain management and other programs requiring compliance prior to authorizing construction in order to simplify administration and reduce the burden on applicants.[11]

Local programs must comply with minimum state regulations, which shall:

- require post-development runoff to approximate pre- development runoff;
- establish minimum design criteria for measures to control nonpoint source pollution and local flooding. (The stormwater criteria in the Erosion and Sediment Control Handbook must be included.);
- require the long-term maintenance of control devices; and,
- include minimum administrative procedures.[12]

Localities may adopt requirements that are more stringent than the state program based on comprehensive local watershed management studies. All state agencies are to comply with the minimum state program.

Through the Statewide (nondesignated area) 208 Planning Program, the SWCB developed the Best Management Practices Program. Handbooks for Best Management Practices for nonpoint source pollution control in Urban, Agriculture, Forestry, Mining, Sources Affecting Groundwater and Hydrologic Modifications were developed. A handbook describing management (administrative) procedures was also developed. These handbooks describe design standards and specifications and appropriate applications of each technique.[13] While voluntary in nature, the State BMP Program relies on and incorporates regulatory measures, such as the Erosion and Sediment Control Program, where they are already in place. At the present time, the Handbooks are in various stages of revision and refinement. It is expected that, increasingly, this program will be integrated with the State Nonpoint Source and Stormwater Management Programs and the CBPA.

Groundwater Management

Through the SWCB, Virginia has a program to manage groundwater, primarily from a quantity standpoint. This program, enacted pursuant to the Groundwater Act of 1973, requires that permits be issued for groundwater uses in excess of 10,000 gallons per day in designated Groundwater Management Areas.[14] Two areas have been designated - Southeastern Virginia and the Eastern Shore. The SWCB is presently evaluating the designation of the York-James Peninsula as a third area. During 1986-87, the SWCB chaired the State Groundwater Protection Steering Committee. The Committee recommended several actions to improve Virginia's ability to manage groundwater, especially from a quality standpoint.

The Strategy, which evolved from this process, established the State's Anti-degradation Policy as the basis for groundwater protection efforts. It recommended that groundwater quality standards be revised, an effort which is currently underway. As presently structured, the Groundwater Protection Strategy relies on existing water quality regulatory programs including programs to regulate septic tanks as well as solid and hazardous wastes and increased enforcement in all program areas. It recommends that local governments incorporate groundwater protection into their comprehensive plans and associated regulatory measures and that efforts to obtain additional funding for various facets of the program be instituted.[15] Legislation to enable local governments to address groundwater protection through their comprehensive plans and land use regulations was enacted by the 1988 General Assembly.[16]

Other State Programs

The CERWMP: PMR reviewed several other programs that affect local ability to manage environmental quality and land use development. They include:

- Virginia Marine Resources Commission - Wetlands, Sand Dunes, and Subaqueous Lands. The Wetlands and Sand Dunes Programs are implemented through locally-established Wetlands Boards.

- U.S. Army Corps of Engineers - Permit programs affect all construction in navigable waters of the United States, defined to include wetlands. These programs are authorized by a number of federal statutes, including Section 404 of the Clean Water Act. Development in nontidal wetlands has come under increasing scrutiny.

- Spill Prevention Control and Countermeasures Plan - This program is operated jointly by the EPA and the SWCB. It applies to all public and private facilities which have substantial above or below ground petroleum product storage capacity.

- Underground Storage Tanks - Established by the Hazardous and Solid Waste Amendments of 1984, this program is implemented by the SWCB. It applies to underground tanks used to store petroleum and substances defined as hazardous under the Superfund Program, but not substances regulated as hazardous under the Resource Conservation and Recovery Act.

- Virginia Sewerage Regulations - Implemented by the Virginia Department of Health in cooperation with the SWCB, these regulations deal primarily with the design and operation of point sources.

- Coastal Resources Management Program - Networked through the VCOE, this program incorporates existing state regulatory programs in Fisheries, Subaqueous Lands, Wetlands and Dunes Management, Point and Nonpoint Source Pollution Control, Shoreline Sanitation and Air Pollution Control.[17] It can be expected that new programs, such as the CBPA, will be incorporated into this program in the future. All basin localities have and are participating in one or more facets of this program.

- Solid and Hazardous Waste Management - Both programs are implemented by the Department of Waste Management. Significant improvements have been made in the Solid Waste portion of these programs in the past year with the adoption of new Solid Waste and Infectious Waste Management Regulations. Initiatives adopted during the 1989 session of the Virginia General Assembly in the areas of planning, recycling and facility siting will result in increased regulatory activity.[19]

Regional Programs

There are no regional land use or nonpoint source management programs of a regulatory nature. Regional agencies, such as the SVPDC and the HRWQA, provide considerable technical assistance to local governments in their efforts to control nonpoint source pollution. Their direct involvement in land use management has not been as extensive. The SVPDC has prepared regional plans for solid and hazardous waste management, which are presently being implemented by the Southeastern Public Service Authority of Virginia. Through the SVPDC, local governments in Southeastern Virginia are cooperating with the U.S. Geological Survey to develop and refine tools to assist in our efforts to manage groundwater quantity.[20] Groundwater quality and its relationship to land use management is being addressed through an ongoing SVPDC study under the VCRMP. Both the SVPDC and the HRWQA are active participants in several of the state and federal initiatives to improve our abilities in these areas.

The Hampton Roads Sanitation District operates a nationally recognized Industrial Waste Discharge Permitting System as part of its effort to provide wastewater treatment service to the Hampton Roads region, including the Elizabeth River Basin. This program is designed to ensure that industrial discharges to the municipal treatment system meet pretreatment requirements and do not have an adverse impact on the municipal wastewater treatment system. Since 1986, the City of Portsmouth has become a full member of HRSD; thus, the Industrial Waste Discharge Permitting System now covers the entire Elizabeth River Basin.

The Southeastern Public Service Authority of Virginia adopted a regional hazardous waste management program in 1986. That program, which is still evolving, includes an industrial waste certification program and extensive efforts to provide hazardous waste and recycling services to citizens. Used oil recycling (drop-off) centers are provided, as are drop-off points for other conventional solid wastes. A curbside recycling program has been instituted on a pilot basis. Over the past three years, SPSA has conducted six Collection Days for Household Hazardous Wastes. In June 1989, a permanent collection facility for such wastes will be opened on a full-time basis. An inventory of small quantity generator hazardous waste is being conducted as the first step in determining the need for and feasibility of a permanent hazardous waste transfer facility for the region.

Local Programs

Chesapeake

The City of Chesapeake has enacted the full range of land use and environmental protection measures. These include Zoning, Subdivision Control, Wetlands, Flood Plain Protection, Erosion and Sediment Control and Public Facility design standards and criteria. These programs were reviewed and analyzed in detail in a 1985 study for the HRWQA.[21] (The reader is referred to that study for a detailed discussion of the Chesapeake regulatory system.)

That analysis concluded that, although water quality had not received formal recognition as a City goal, the operation of a number of programs by the City had ancillary water quality benefits. The study indicated that the regulatory programs were generally flexible enough to accommodate water quality protection and nonpoint control. This was particularly true of the rezoning and conditional use permit processes under the Zoning and Subdivision Control Ordinances. It was also noted that air quality considerations had been incorporated into the requirements for the M-1, Manufacturing District; thus, establishing the precedent for considering water quality issues in the Zoning Ordinance.[22] Also, the A-1, Agricultural,and C-1, Conservation, Districts were being used to protect the quality of the water in the Northwest River, the City's primary water supply.[23] The Conditional Use Permit procedures, as they related to Manufacturing, were noted as affording potential water quality benefits, because they applied to most activities involving outside materials storage. Recommendations for improving the City's capability to respond

to water quality and, in particular, to nonpoint source control issues were included. Those conclusions and recommendations were reiterated in the CERWQMP: PMR.

Since 1986, the City has undertaken a thorough rewrite of its Comprehensive Plan and associated land use regulatory ordinances. The revised Comprehensive Plan includes an extensive statement of City goals, objectives and policies. That portion of the Plan, reviewed in Appendix B, includes formal adoption of water quality and related environmental protection goals. The accompanying technical documentation and implementation portion of the Plan is presently being drafted. It is to include a full discussion of environmental protection techniques and the rationale for them. The City's Zoning and related ordinances are also being revised. Final versions of these ordinances were not available for review for this study. Assuming their consistency with the City's adopted goals statement, it can be expected that they will incorporate greater consideration of environmental factors.

Norfolk

The City of Norfolk has enacted a Zoning Ordinance, which includes the Flood Plain Zoning Ordinance. The City has also enacted Wetlands Zoning and Dune Protection Ordinances, an Erosion and Sediment Control Ordinance and a Subdivision Ordinance. Site plan review procedures were adopted in 1987.[24] All are enacted in accordance with the appropriate State enabling legislation and include, in a statement of purpose, a reference to the relevant section of the Virginia Code.

An extensive review of the City's land use development regulations was included in the CERWQMP: PMR. (The interested reader is referred to that document for a detailed discussion of these regulations.) That analysis concluded that the City's regulatory system contained sufficient flexibility to deal with water quality and other environmental issues. Recommendations for improving the City's regulatory system to better accommodate those needs were made. They included incorporating water quality protection as a specific City goal and regulatory objective. Several aspects of the City's development regulations were noted as offering potential help for water quality protection. Others were noted as establishing a precedent for such efforts. They included the Flood Plain Ordinance, Zoning Ordinance, Subdivision Regulations and the several environmental protection ordinances.

While the Flood Plain Ordinance deals primarily with water quantity related restrictions on development, it establishes the precedent for water quality related restrictions in defined areas. The Subdivision Ordinance provisions for drainage likewise are directed at protection of property and persons from excess quantities of water. However, water quality considerations could be incorporated readily. Obviously, the several environmental protection ordinances - Wetlands, Erosion and Sediment Control and Sand Dunes - provide some degree of water quality protection.

Specific provisions of the Zoning Ordinance which hold promise as vehicles for giving increased attention to water quality protection include the Manufacturing District regulations and the Conditional Use Permit provisions. The Manufacturing District regulations require that a Conditional Use Permit be obtained for most heavy industries, such as chemical manufacturing, petroleum refining, fertilizer manufacturing and ore smelting, which could have a significant water quality impact.[25] The list includes most activities that involve the manufacture or storage of hazardous materials. Finally, the Waterfront Industrial District promotes the City's goal of encouraging port-related development of its waterfront, by giving such uses a priority for waterfront locations.[26] The Conditional Use Permit provisions do not require consideration of water quality in evaluating proposed uses. They do, however, require consideration of a range of other environmental factors including noise and air quality. Thus, the precedent for considering water quality has been established.

In November 1987, the City adopted a Site Plan Review Ordinance governing development of multi-family housing. Among the factors to be considered in the Site Plan Review process are:

- the project's compatibility with its environment;
- the quantity, quality, utility, size and type of the project's required open space, impact upon existing natural environment and proposed landscaping improvements;
- the location and adequacy of the project's provision for drainage and utilities.[27]

Information which is required to be submitted by the developer for the Site Plan Review process is fairly extensive and includes much of the information necessary to evaluate a project's environmental impacts. It should greatly enhance the ability of the City to respond to the requirements of the CBPA. With respect to storm drainage, the Site Plan Ordinance requires that stormwater be disposed of without adversely impacting on public or private property. This provision appears to offer consideration of water quality in that it is not specifically restricted to the question of quantity. At the present time, this Ordinance does not apply to commercial and industrial activities.

The City has embarked on a complete revision to its Comprehensive Plan and land use development regulations. That effort is expected to be completed sometime during 1990. It is expected to improve the readability and usefulness of the Ordinances and will include a more extensive consideration of environmental protection. It should be noted that Norfolk has already taken steps to improve its institutional ability to respond to environmental issues through interdepartmental reorganization and addition of environmental planning staff in some departments.

Portsmouth

The City of Portsmouth has also adopted the standard regulatory measures, which directly or indirectly impact on water quality. They include Zoning, Subdivision, Flood Plain and Erosion and Sediment Control Ordinances. The City enacted the Wetlands Ordinance and established a Wetlands Board in 1988. Again, all of these ordinances are enacted in conformance with State enabling legislation. They all reflect the purposes of that enabling legislation by direct reference or incorporation.

The Zoning Ordinance of the City of Portsmouth, adopted initially in 1961, was extensively revised in 1972. A complete rewrite of the Ordinance was completed late in 1988, in conjunction with development of a revised Comprehensive Plan. The new Zoning Ordinance is presently undergoing public review. It is expected to be adopted later in 1989. As indicated in Appendix B, the revised Comprehensive Plan provides the policy basis for including water quality protection in the City's Zoning Ordinance and other regulatory measures. Discrete treatment of environmental protection has not been included in the revised Ordinance. City staff indicate that specific provisions dealing with water quality will be incorporated in the Ordinance following its adoption. This will enable the City to include the CBPA Criteria when they are finalized in a comprehensive package of environmental protection measures.

Several features of the draft ordinance are of potential benefit to water quality protection. They include the M-1R, Restricted Manufacturing, and W-1, Waterfront, Districts, parking provisions and the Conditional Use Permit procedure. Most activities in the Restricted Manufacturing District require conditional use permits. While the Ordinance does not presently address water quality protection, this provision would readily permit such consideration.[28] The W-1 District is established to provide for activities requiring or benefitting from a waterfront location, including most activities providing some element of public access to the waterfront.[29] The parking lot requirements allow for use of the parking lot as temporary storage of stormwater, often cited as a Best Management Practice.[30] This provision could be of assistance in implementation of the Regional Stormwater Management Strategy. Finally, information required to be provided in applications for a conditional use permit encompasses many of the environmental features that are being considered in the CBPA Criteria. The Conditional Use Permit process also requires special consideration of landscaping and buffering.

The City enacted a Subdivision Ordinance in 1972. The Ordinance contains a specific prohibition on the subdivision of land which is unsuitable due to flooding, bad drainage, or other harmful features. It includes a requirement for preservation, to the maximum degree possible, of historic sites and environmental features. Drainage improvements are to be made in accordance with requirements established by the City Engineer and which reflect the design standards and

specifications of the Virginia Department of Transportation. If land is available, on-site retention is to be provided.

The CERWMP: PMR concluded that the foundations of a water quality management program for the City of Portsmouth had been laid. A number of recommendations for improving the City's ability to deal with water quality and other environmental issues were made. Many of these have been accomplished over the last three years. As noted earlier, the City has adopted protection of water quality and related environmental features as goals of its Comprehensive Plan and has indicated its intent to incorporate those goals into its regulatory measures. The Comprehensive Plan also includes a specific shoreline (coastal zone) management element.[31] If adopted, the Environmental Management Strategies contained in the shoreline element would significantly enhance the City's ability to manage development in a manner that is protective of its natural resource base. A Wetlands Ordinance has been adopted as the first step in that effort.

Virginia Beach

Zoning, Subdivision, Flood Plain, Wetlands, Primary Sand Dune, and Erosion and Sediment Control Ordinances have also been adopted by the City of Virginia Beach. As in the case of the other three jurisdictions, all of them incorporate the purposes of the standard State enabling legislation either directly or by reference.

The CERWQMP: PMR concluded that the regulatory ordinances of the City afforded considerable potential water quality benefit. Especially noteworthy at that time were the:

- Wetlands Ordinance, at least in part, due to the extensive tidal wetlands found in the Virginia Beach portion of the Elizabeth River Basin.

- Zoning Ordinance provisions for Open Space Promotion and Planned Unit Development as well as Conditional Use Permits.

- Subdivision Ordinance requirements for the preservation of noteworthy natural features.

A number of recommendations for further improvement in the form of specific consideration of water quality in planning and land use regulation were made.

The period since completion of the CERWQMP: PMR in 1986 has been a very active one for the City of Virginia Beach. As noted earlier, steps to improve the ability of City departments to respond to water quality and other environmental issues have been taken. A report completed by the City in 1987 laid the groundwork for this organizational improvement as well as for extensive revisions to the City's development regulations. The 1987 report incorporated the conclusions of the

CERWQMP: PMR and adopted many of its recommendations. In particular, it noted that water quality would be a significant criteria for development review and public decision-making for the Elizabeth River Basin among others.[32]

Based in part on the conclusions of the 1987 City report, the Virginia Beach City Council adopted an extensive revision of the Zoning Ordinance in April 1988. Concurrently, revisions to other development regulations, new Landscaping and Buffering Criteria and a Comprehensive Stormwater Management Ordinance were adopted.

As was true in 1986, it does not appear likely that the Zoning Ordinance will be the most effective development control for water quality benefits in the basin. The Conditional Use Permit provisions continue to appear to be the most effective aspect of the Ordinance in this regard. This is especially true in the Industrial Districts, where most uses involving outside storage of materials or heavy manufacturing activity require a Conditional Use Permit. This affords the City the opportunity to address the specific water quality issues inherent in any development proposal.[33]

The Landscaping and Buffering Standards and Criteria require the preservation of existing buffers and the establishment of new buffers.[34] Directed primarily at ensuring compatibility between adjacent uses, these Criteria in conjunction with the Zoning Ordinance could be modified to address protection of natural areas through preservation of natural buffers.

The most significant revision to the City's development control package is the Stormwater Management Ordinance adopted in 1988. This Ordinance is based on an acknowledgement of the adverse water quality impacts of development. It establishes a wide range of objectives, including prevention of water quality degradation and restoration of the integrity of the City's waters. To achieve these objectives, the Ordinance requires the approval and implementation of stormwater management plans for all activities that could have an adverse impact on the City's waters.

Specifically, a stormwater management plan must be submitted and approved:

- before an existing drainage system is altered, rerouted, deepened, enlarged or obstructed in preparation for development;
- before or concurrent with the submittal and approval of an erosion and sediment control and tree protection plan as specified in the Erosion and Sediment Control and Tree Protection Ordinances; or
- before development is commenced.[35]

Exemptions are provided for development of less than five single family or duplex residences and their accessory structures, agricultural activities and routine

maintenance activities. Waivers and variances may also be granted under limited circumstances. The required plan submittal contains extensive information requirements which should assist the City in implementing the draft CBPA Criteria.

The Stormwater Management Ordinance establishes specific performance criteria that must be met by all development which is subject to the Ordinance. Essentially, these criteria require that any development maintain runoff flow and timing at approximately the same level as existing conditions and, to the extent practicable, as predevelopment conditions. An off-site drainage facility can be provided in lieu of this requirement. Other performance criteria deal with protection of habitat, groundwater levels and quality, wetlands and other properties as well as prevention of saltwater intrusion. The design storm varies from a 10 year storm to a 50 year storm, depending on the size of the parcel.[36]

Specific design criteria are also established in the Ordinance and in the accompanying Manual of Stormwater Management Practices. These reflect the State Stormwater Management Criteria and commonly accepted definitions of Best Management Practices. Maintenance of the required BMPs and other facilities by the developer is required. If it appears unlikely that necessary maintenance will be accomplished for any reason, the facilities must be dedicated to the City. Violations of the Ordinance are considered to be a public nuisance, subject to both civil and criminal penalties.

COMPATIBILITY ASSESSMENT

A number of state, regional and local institutions, which are in place to address either land development or water quality or both, have been described. Each of these operates a broad range of programs in one or both of these areas. Each program, in turn, has established processes for dealing with one or both of these issues. At the state level, the historical emphasis has been on water quality matters. Land development has been a concern only as it relates to water quality or other natural resource concerns. This has changed significantly in the past two years with passage of the Chesapeake Bay Preservation Act and the signing of the 1987 Chesapeake Bay Agreement. Both of these place substantially increased emphasis on the question of land use development. Also, planning enabling legislation has been amended to require consideration of both surface and ground water quantity and quality.

State institutions consider land development from the perspective of providing guidance or assistance to local governments. This concept is inherent in the name of the agency established to implement the CBPA - the Chesapeake Bay Local Assistance Board and Department. The Virginia Council on the Environment has also increased its involvement in this area with the establishment of a local assistance section.

Regional institutions have emphasized water quality and other natural resource and infrastructure considerations. At the planning level, they also devote considerable effort to the provision of technical assistance on land use matters. In doing so, these agencies generally address land use from the perspective of its relationship to major components of the public infrastructure or major natural resources. At the regional level, program direction is not significantly different than it was in 1986.

Local institutions place their emphasis on land development issues. Water quality has recently, since 1986, received formal recognition as a City goal in all Basin jurisdictions. To date, however, this goal has been translated into a regulatory purpose only in the Erosion and Sediment Control Ordinance and, in Virginia Beach into the Stormwater Management Ordinance. Ancillary water quality benefits result from the operation of many City programs, including the provision of municipal utilities, drainage criteria and requirements and some regulatory programs, such as wetlands protection.

With one exception, the development review and approval processes at the local level do not provide for discrete, special consideration of water quality issues. The City of Virginia Beach with its Stormwater Management Ordinance is the one exception. It is expected that this situation will change over the next year, as all basin localities incorporate water quality protection into their regulatory ordinances in response to the CBPA. Currently, there does not appear to be any procedural roadblock to consideration of water quality.

This study has examined the compatibility of existing regulatory programs with achievement of the water quality and river use/character goals established for the Elizabeth River. This compatibility has been categorized in terms of conflict, potential conflict and compatibility. No local development regulation conflicts directly with those goals.

Several of the programs present potential conflicts. Generally, this is inherent in programs which are designed to achieve a wide range of goals and objectives, including economic development, environmental protection and governmental efficiency and responsiveness. For example, Zoning Ordinances, in general, represent a potential conflict as they are used to achieve divergent goals. Waterfront commercial or industrial districts may assist in revitalizing urban downtowns through more intense use of waterfront land, while concurrently increasing urban runoff and associated nonpoint pollutant loads. Similarly, the Subdivision Ordinance may require the use of curbs and gutters along subdivision streets and the use of underground piped drainage for flood protection and aesthetic reasons, while concurrently speeding the flow of runoff and pollutant to the nearest receiving water. Conversely, stormwater management ordinances may increase the cost of development and housing, contributing to the housing affordability issue.

Modifications to the ordinances and the adoption of additional or alternative management programs and standards may resolve some of these conflicts. However, only a reasoned decision-making process can adequately balance the potentially conflicting goals.

Finally, many local regulatory programs are mutually supportive of the achievement of water quality goals. They include Wetlands Zoning, Flood Plain regulations and requirements for connection to the municipal sewer system. Stormwater Management Ordinances, similar to the one recently enacted by the City of Virginia Beach, are clearly supportive of the water quality goals. Local and regional solid and hazardous waste control programs also assist in this effort.

The institutional capacity to address water quality management in the local development process is present in all jurisdictions in the Elizabeth River Basin. Review and approval procedures appear to offer the flexibility necessary to accommodate water quality protection and nonpoint source pollution control. The existing regulations at the local level are not diametrically opposed to achievement of Water Quality Act goals. However, they can and have been improved to be more supportive of those goals.

ENDNOTES

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[4]Chesapeake Bay Preservation Act, Chapter 608 Acts of Assembly 1988, Title 10, Chapter 25 Code of Virginia, 1950, as amended.

[5]"Chesapeake Bay Agreement," December 15, 1987.

[6]U.S. Environmental Protection Agency, "National Pollutant Discharge Elimination System Permit Application Regulations for Storm Water Dischargers; Proposed Rule," (40 Code of Federal Regulations, Parts 122, 123, 124 and 504) at 53 Federal Register 49416, December 7, 1988.

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[8]Ibid, Sections 3.2 and 3.3.

[9]Virginia Division of Soil and Water Conservation, Erosion and Sediment Control Handbook (Richmond, Virginia: The Division, 1980).

[10]Virginia Division of Soil and Water Conservation, Virginia Nonpoint Source Management Program (Draft) (Richmond, Virginia: The Division, 1989).

[11]Senate Bill 722/House Bill 1848, entitled "Stormwater Management," amending Title 10.1, Chapter 6, Code of Virginia, 1950, as amended, Section 10.1-603.3.

[12]Ibid, Section 10.1-603.4.

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[18]Virginia Department of Waste Management, Solid Waste Management Regulations, VR672-20-10 (Richmond, Virginia: DWM, 1988).

[19]See for example House Bill 1743 amending Section 10,1-1411 of the Code of Virginia, 1950, as amended.

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[23]Ibid, Article VII.

[24]City of Norfolk, Site Plan Review, Chapter 32.1 of the City Code of Norfolk, (Ordinance 34,815, November 24, 1987).

[25]City of Norfolk, Zoning Ordinance, Article VI, "Use Permits."

[26]Ibid, Section 380.

[27]City of Norfolk, Site Plan Review, Section 32.1 (b).

[28]City of Portsmouth, Draft Zoning Ordinance Update (Portsmouth, Virginia: The City, 1988), Section 40-43.

[29]Ibid, Section 40-41.19.

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[31]Woolpert Consultants, Coastal Zone Management Plan: City of Portsmouth, Virginia (Portsmouth, Virginia: The City, 1988).

[32]Department of Planning, A Report With Recommendations for Improved Management of Environmental Resources (Virginia Beach, Virginia: The City, 1987), p. 24.

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APPENDIX D

REVIEW

OF

SELECTED STATE LAND USE

AND

NATURAL RESOURCE MANAGEMENT PROGRAMS

REVIEW OF

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NATURAL RESOURCE MANAGEMENT PROGRAMS

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Prepared By

HAMPTON ROADS WATER QUALITY AGENCY

JULY 1988

INTRODUCTION

The Comprehensive Elizabeth River Water Quality Management Plan-Preliminary Management Recommendations (CERWQMP)[1] included several alternatives for defining a Critical Management Area within the Elizabeth River watershed. While one approach was suggested, none received an overwhelming consensus among the user groups participating in the review process.

This report, which documents a review of several State's approaches to the designation and management of special resource management areas will be used to further the effort toward designating such an area in the Elizabeth River watershed.

Four State programs are included in the review:

- Virginia Chesapeake Bay Preservation Act
- North Carolina Coastal Area Management Act
- Maryland Critical Area Law
- Oregon Comprehensive Planning and Growth Management Law of 1973 (as amended in 1976)

Also, some features of the Florida program are included in a tabular summary of key program characteristics. With regard to the Virginia Chesapeake Bay Preservation Act it should be noted that it represents legislative action by the 1988 General Assembly and is yet to be implemented. It will be a mandatory program, applicable to the Elizabeth River watershed. The programs of other States should be considered from the perspective of benefitting from lessons learned elsewhere. Certainly, that will be the approach taken by HRWQA in the subsequent task of recommending a critical management area for the Elizabeth River, based on knowledge gained through this review.

In addition to state program documents, the HRWQA has obtained local responses from North Carolina and Maryland which will be useful in applying this review to the Elizabeth River. Those local responses are documented in the Endnotes.

TABLE 1

COMPARATIVE FEATURES OF STATE LAND USE MANAGEMENT PROGRAMS

Geographic Scope	North Carolina Coastal Zone	Maryland Critical Area	Florida State	Oregon State	Virginia Critical Area
Mandatory Zoning/Planning					
*Statewide			X	X	
*Regional			X		
*Selected Jurisdictions	X	X			X
*Parts of Jurisdictions		X			X
State Review of Plans	X	X	X	X	X
State Review of Amendments	X	X	X	X	X
Minimum State Standards	X	X	X	X	X
State May Contest or Appeal Local Land Use Decision		X	X	X	X
State Permit Requirements					
*Based on Project Size	X		X		
*Based on Project Location		X	X		
*Based on Other Criteria		X			
*No State Permit Needed				X	X
Local Government May Assume Some Permit Authority	X				
Program Administration By					
* Special Board/Commission	X	X		X	X
*New State Office			X		X
*Existing State Office	X				
Type of State Assistance					
*Financial	X	X	X	X	X
*Technical	X	X	X		X

Source: Adapted from material provided by the Institute of Environmental Negotiation, University of Virginia, for the Chesapeake Bay Land Use Round Table, 1987.

VIRGINIA CHESAPEAKE BAY PRESERVATION ACT

INTRODUCTION

The Chesapeake Bay Preservation Act was passed by the Virginia General Assembly in 1988. The Act represented the culmination of discussions and reporting by the Chesapeake Bay Land Use Roundtable. Over an eighteen month period, the Roundtable, a group of individuals from a variety of different interest groups, discussed the need for a greater state role in local land use management. The final report of the group, Land Use Initiatives for Tidewater Virginia: The Next Step in Protecting the Bay,[2] was used by the General Assembly as the basis for the Act.

The Act establishes a Chesapeake Bay Local Assistance Board to be composed of nine gubernatorial appointees. Additionally, the Act requires the creation of a new state department, the Chesapeake Bay Local Assistance Department. The Director of the Department is also to be a gubernatorial appointee, operating under the direction and control of the Secretary of Natural Resources.

Generally speaking, the Board and the Department are to develop a land use management program which is protective of Chesapeake Bay water quality, to be implemented at the local level. To accomplish that mission the Board is to define Chesapeake Bay Preservation Areas within which the program is applicable.

CHESAPEAKE BAY PRESERVATION BOARD

The Board is to have nine members, one from each Planning District Commission area within Tidewater as defined by the State Code. The primary responsibilities of the Board are:

- Develop the procedures to be used by local governments in defining the Chesapeake Bay Preservation Area, in accordance with the minimum criteria for such area as defined by the Board.

- Develop regulations which establish criteria for use by local governments in granting, denying, or modifying requests to rezone, subdivide, or to use and develop land in the Chesapeake Bay Preservation Area.

- Provide financial and technical assistance to local governments and regional and state agencies in support of requirements of the Act.

- Ensure that local government comprehensive plans, zoning ordinances, and subdivision ordinances are in accordance with the provisions of the Act. Determination of compliance must be in accordance with the provisions of the Administrative Processes Act. (As explained by Jeter "Bud" Watson, one of the drafters of the Act, this means a locality is presumed to have complied until the State proves otherwise. To prove

otherwise, the State must follow a formal hearing process spelled out in the APA.)

- In conjunction with the above, the Board is charged to take administrative and legal actions to ensure compliance by counties, cities, and towns with the provisions of the Act.

There are seven other specific responsibilities of the Board.

CRITERIA

Criteria having two purposes are to be promulgated by the Board: 1) criteria for defining the Chesapeake Bay Preservation Area; and, 2) criteria governing the use and development of land in the Area.

In developing the criteria, the Act charges the Board with considering all factors relevant to the protection of water quality. The criteria must incorporate performance standards, best management practices, and various planning and zoning concepts to protect the quality of state waters. When applied by localities, the criteria must assure that existing high quality state waters are maintained, that all other state waters are restored to a level supportive of indigenous populations, and that no increase in pollution will result.

The criteria are to be adopted by July 1, 1989.

REQUIREMENTS OF LOCAL GOVERNMENTS

Local governments are required to implement the purposes of the Act. Included in their responsibilities are:

- Designation of the Chesapeake Bay Preservation Area in accordance with the state criteria, no later than twelve months after the state criteria are adopted.

- Incorporation of the land use and development criteria into their comprehensive plan, zoning ordinance, and subdivision ordinance. (All Tidewater jurisdictions are required by the Act to have zoning ordinances.)

- Application of those ordinances must be in accordance with the criteria promulgated by the Board and must ensure that the use and development of land in the Chesapeake Bay Preservation Area is accomplished in a manner that protects the quality of state waters.

OTHER PROVISIONS

Other key provisions of the Act are:

- Local governments are specifically authorized to use their police and zoning powers to protect the quality of state waters.
- The Board, at the request of a locality, must perform an advisory review of any development application for conformance with the Act. Such a review must be completed within ninety days of the request.
- State agencies are to comply with local ordinances which comply with the Act.

NORTH CAROLINA COASTAL AREA MANAGEMENT ACT

INTRODUCTION

The basic legislation creating the North Carolina Program is the Coastal Area Management Act (CAMA) of 1974. The purpose of the Program is to manage coastal development in a way which strikes a balance between the use and preservation of coastal resources. The Act established the Coastal Resources Commission (Fifteen citizens appointed by the Governor) and the Coastal Resources Advisory Council (Forty-seven members) to develop the policies and standards of the coastal program. The Commission sets the goals, policies, and specific regulatory standards which address the needs of the coastal area and its residents. The Council, made up of local officials, scientists, government agencies and others, advises the Commission on coastal concerns.

The program is staffed by the North Carolina Department of Natural Resources and Community Development - Division of Coastal Management, which works closely with local government officials in the preparation of required land use plans and the management of the CAMA Permit program. Local towns and counties prepare land use plans, establish public beach access sites, and administer permits for minor development in Areas of Environmental Concern (AEC).

The overall framework of the program has three essential elements; 1) land use planning, 2) regulating development, and 3) protecting significant natural areas. These elements are described in further detail:

> "The interlocking elements each have a different role to play in balancing the use of coastal resources. Land use planning, for instance, lays the ground work for both long-range resource use and daily decisions about where homes and shopping centers can best be located, and which areas need to be left in their natural state.

Issuing permits for development in areas of environmental concern is the primary mechanism in the program which maintains the equilibrium between resource use and preservation. The permits, required for development in the estuarine system, ocean hazard, public water supply, and natural and cultural resource areas of environmental concern, are only granted if a project meets the standards set by the Coastal Resources Commission. Frequently a permit will include specific conditions to ensure that the resources being used will be damaged as little as possible.

Natural area preservation, through the Public Beach Access and North Carolina National Estuarine Sanctuary programs, ensures that significant areas will be protected for the use of the public. The beach access program has established more than 350 sites along the coast where people can get to the beach without crossing private property. The estuarine sanctuary system provides a natural outdoor laboratory where students, scientists, and the public can come to study, do research, or bird watch and fish."[3]

CAMA LAND USE PLANS

All twenty of the coastal counties subject to CAMA must prepare and adopt a local land use plan. The North Carolina Department of Natural Resources and Community Development - Division of Coastal Management has prepared Guidelines which stipulate the minimum requirements for such land use plans.[4] Each plan must include:

- Data collection and analysis of present conditions in the county including population, employment, existing land uses, physical and natural conditions including infrastructure, constraints on development, current plans and policies and regulations.

- Existing land use map.

- Policy discussion regarding resource protection, resource production and management, economic and community development, continued public participation and storm hazard mitigation.

- A land classification map reflecting the application of a land classification system within the jurisdiction. The land classifications are to be linked with the policy section. Land is to be classified in five categories based on existing uses and future needs:

    1) Developed. This includes already developed lands where additional development should take place.

    2) Transition. This area is to accommodate future development.

3) Community. This area is to provide for clustered, mixed use at low densities in rural areas.

4) Rural. Lands for agriculture, forestry, mineral extraction and other low intensity uses.

5) Conservation. This includes public trust waters, estuarine waters, coastal wetlands, and other environmentally and culturally significant areas.

The land classification system is considered a tool and is not a strict regulatory mechanism.[5] The local land use plans are reviewed for conformance to the minimum state guidelines and when approved by the CRC become an integral part of the Coastal Management Plan.

CAMA PERMIT PROGRAM

Development within the Area of Environmental Concern (AEC), unless specifically exempted, requires one of four types of permits: 1) Major Development Permit, 2) Minor Development Permit, 3) General Permit, and 4) Emergency Permit.

Four major types of AECs have been established. They are an Estuarine System AEC, an Ocean Hazard System AEC, a Public Water Supply AEC, and a Natural/Cultural AEC. In most cases, if property meets one of the following tests, it is considered to be in an AEC:

- In or on the waters of the state.
- On a marsh or wetland.
- Within 75 feet of the mean high water line along an estuarine shoreline.
- Within 300 feet of the ocean beach.
- Within 1000 feet of an inlet.
- Near a public water supply designated as an AEC.

Major Development Permits are required when the development activity exhibits one or more of the following characteristics:

- Alteration of more than twenty acres of land or water within an AEC.

- Involves a structure(s) covering more than 60,000 square feet on a single parcel of land.

- Drilling or excavation for natural resources on land in an AEC or under water.

- Another state or Federal permit, license, or authorization is required (dredging and filling, sedimentation control, NPDES, or mining).

Major Development Permits are administered directly by the Division of Coastal Management and the Coastal Resources Commission. Development activities which do not exhibit any of the above characteristics but are within an AEC must obtain a Minor Development Permit, unless specifically exempted. Minor Development Permits are administered by the local government within which the project is located.

In the case of both major and minor permits, exemptions are reasonable in allowing minor additions and maintenance for existing projects.

DEVELOPMENT STANDARDS

General Standards and Specific Standards have been developed and are applied to each major and minor permit applicant as appropriate, for development within the Estuarine System AECs (including general standards for Coastal Wetlands, Estuarine Waters, and Public Trust AECs) and Ocean Hazard System AECs. Specific Standards have also been developed for Public Water Supply AECs.

In the case of Estuarine Shoreline AECs, for example, projects within 75 feet of the mean high water line must meet the following General Standards:

- Development shall not cause significant damage to estuarine resources.

- Development shall not interfere with existing public rights of access to, or use of, navigable waters or public resources.

- All development projects shall preserve and not weaken natural barriers to erosion, including (but not limited to) peat marshland, resistant clay shorelines, and cypress-gum fringe areas.

- No major facility paid for in any part by public funds shall be permitted if it is likely to require extraordinary public expenditures for maintenance and continued use, unless the public purpose served by the project outweighs the required public expenditures.

- Impervious surfaces shall not exceed 30 percent of the lot area located within the AEC, unless such a limitation will allow no practical use to be

made of the lot OR the applicant can prove that the project's design can protect natural drainage as well as the 30 percent coverage limit. All development projects shall limit the construction of impervious surfaces, and other areas prohibiting natural drainage, to only the area necessary to adequately serve the major use of the lot.

- All development projects shall meet the standards of the N.C. Sedimentation Pollution Control Act of 1973.

- Development shall not cause major or irreversible damage to valuable, documented historic architectural or archaeological resources.

- The project must comply with the local land use plan.

The CRC does not require a minor development permit for single family residences built within the estuarine shoreline AEC which are more than 40 feet from the mean high water mark, or normal water level. Also exempted is work to repair, or construct private bulkheads with backfill, to place riprap along shorelines, and to construct piers and moorings in the coastal waters. This exemption does not apply to commercial or multi-family unit residential development. In both exemption cases the project must still be reviewed by the local permit official to make certain exemption conditions are met.

In addition to the General Standards, Specific Standards are also applied to several specific types of activities within the different categories of AECs. For example, in the Estuarine System AEC the following activities have Specific Standards which must be met:

- Hydraulic Dredging
- Navigation Channels, Canals, and Boat Basins
- Docks and Piers
- Bulkheads and Shoreline Stabilization Measures
- Wooden and Riprap Groins
- Marinas
- Drainage Ditches
- Nourishment of Estuarine Beaches

Using marinas as an example, the following Specific Standards would have to be met to receive a CAMA permit:

- Marinas should be built on non-wetland sites or in deep waters not requiring dredging. They should not disturb valuable shallow water and wetland habitats, except for dredging necessary for access to high-ground sites. The following four alternatives for siting marinas are ranked in order of preference; marinas must be designed to meet the highest priority that is feasible:

  1) an upland site requiring no alteration of wetlands or other estuarine habitats and having adequate water circulation to prevent the accumulation of sediment and pollutants in boat basins and channels;

  2) an upland site requiring dredging only for access when it will cause no significant damage to fisheries or wetlands;

  3) a deepwater site that is not a "primary nursery area" and that does not require excavation or wetland alteration; or

  4) a site requiring the excavation of relatively unproductive underwater beds to a depth no greater than the depth of any connecting channels.

- Marinas which require dredging must not be located in "primary nursery areas" (described as being breeding grounds for important fish and shellfish species), nor in areas which require dredging a channel through "primary nursery areas" for access to deeper waters.

- Marinas which require dredging must provide spoil disposal areas adequate to accommodate future maintenance dredging.

- Marinas must not be enclosed within breakwaters that hinder the water circulation needed to maintain water quality.

- Marinas should minimize encroachments into public waters by having a mixture of dry storage areas, public launching facilities, and berthing spaces.

- Marinas must be designed to avoid obstacles to navigation and public use of the waters.

- Marinas should use all measures necessary to minimize damage to natural systems from pollutants released while operating the marina and its maintenance vessels.

- Marinas must prominently display a sign showing the location of the nearest pumpout facility, including the telephone numbers of local septic tank pumping services and other appropriate waste disposal information.[6]

Primary nursery areas are defined as being breeding grounds for important fish and shellfish species as mapped by the N.C. Division of Marine Fisheries.

In addition to the Major Development Permit and Minor Development Permit programs, CAMA also has developed a system for General Permits and Emergency Permits. Experience with the program indicated that certain types of routine development activity which posed little or no threat to the environment should undergo a streamlined permitting process. Consequently the General Permit system was developed. General Permits apply to the following types of development:

- Construction of private piers, docks, and boat houses.
- Stabilization of the estuarine shoreline with bulkheads and riprap along alignments not extending over five feet into the water.
- Construction of wooden groins for estuarine shoreline stabilization.
- Construction of boat ramps along the estuarine shoreline
- Maintenance excavation of channels, canals, boat basins and ditches when excavation does not involve removal of more than 1,000 cubic yards of material.

Each general permit must meet certain standards such as no wetland alteration, no work in primary nursery areas, no impacts on adjoining property, and no unnecessary interference with navigation.

Division of Coastal Management field consultants determine if the project is a candidate for a general permit.

Emergency Permits may be issued when life or structures are in imminent danger as the result of storms, erosion, or a similar occurrence. Decisions regarding these permit applications must be made within two days after completing the permit review, which follows the same procedure as that for Major and Minor permits, whichever is applicable.

Provision is also made in CAMA for variances, appeals and enforcement. Details of those are provided in the document entitled, "A Handbook for Development in North Carolina's Coastal Area."[7] The complete operational description of the CAMA program may also be found in that document.[8]

CONCLUSION

CAMA has resulted in more consistency among coastal jurisdictions in conducting land use planning. All of the local jurisdictions subject to the land use planning requirements of CAMA have approved land use plans. Enforcement of plan elements remains variable among jurisdictions as a result of variation in the application of development control ordinances unique to each jurisdiction (e.g., subdivision and zoning ordinances).

While North Carolina had wetland protection and other coastal resource protection programs prior to CAMA, the permitting processes have been streamlined via CAMA. Further, according to some observers, they have been more aggressively pursued since CAMA passage.[9] Consistency among the various government permitting levels is also enhanced as a result of CAMA procedures.

In spite of the program, land use conversions within the coastal area continue at a rapid rate. Continuing water quality problems, beach access issues, rapid shoreline erosion, and other problems have prompted some to recommend a more comprehensive role for CAMA in terms of functional areas and regulatory coverage.[10]

MARYLAND CRITICAL AREA LAW

INTRODUCTION

The basic legislation creating the Maryland Program is the Critical Area Law of 1984. The purpose of the Law is to establish a resource protection program for the Chesapeake Bay and its tributaries which manages shoreline development so as to minimize damage to water quality and natural habitats.[11] The Law established the Chesapeake Bay Critical Area Commission (Twenty- five members appointed by the Governor). The Commission is responsible for developing the detailed minimum requirements to be included in each local jurisdiction's Chesapeake Bay Critical Area Management Program ("The Criteria").

Each local government adjacent to the Chesapeake Bay, including cities and towns within counties adjacent to the Bay must develop a Critical Area Program consistent with the minimum requirements set by the state. Those programs undergo review and approval (or disapproval/amendment) by the Commission. The state staff for the program works for the Commission with the Executive Director serving at the pleasure of the Chairman.

PROGRAM REQUIREMENTS ESTABLISHED BY STATE

The Chesapeake Bay Critical Area as defined by the Law includes all waters of and lands under the Chesapeake Bay and its tributaries to the head of tide and all State and private wetlands; and, all land and water areas within 1,000 feet beyond

the landward boundaries of State and private wetlands and the heads of tides. Areas which would be within the area but which are already fully developed may, after meeting several conditions, be excluded from the Critical Area.

To protect the Chesapeake Bay, each affected local jurisdiction must develop a Critical Area Program having the following goals:

- Minimize adverse impacts on water quality that result from pollutants that are discharged from structures or conveyances that have runoff from surrounding lands.
- Conserve fish, wildlife, and plant habitat.
- Establish land use policies for development in the Chesapeake Bay Critical Area which accommodate growth and also address the fact that, even if pollution is controlled, the number, movement, and activities of persons in that area can create adverse environmental impacts.

Minimum local program elements are:

- A map designating the critical area.
- A comprehensive zoning map for the critical area.
- As necessary, new or amended subdivision regulations, comprehensive/master plan, zoning ordinance, enforcement provisions, and grandfathering provisions.
- Provisions requiring that project approvals be consistent with the goals.
- Provisions limiting impervious area and encouraging cluster development.
- Establishment of buffer areas along shorelines within which agriculture will be permitted only if BMPs are used.
- Requirements for minimum setbacks for structures and septic fields along shorelines.
- Designation of shoreline areas, if any, suitable for public recreational use.
- Designation of shoreline areas, if any, that are suitable for ports, marinas, and industries that use water for transportation or derive economic benefits from shore access.
- Provisions that all timber harvesting in the critical area be in accordance with plans approved by the forestry board.

- Provisions establishing controls in a program which are designed to prevent runoff of pollutants will not be required on sites where the topography prevents runoff from directly or indirectly reaching tidal waters.

If the locality does not develop the required program or the program submitted is not approved by the Commission, then the Commission must develop the program for the locality. Grant funding from the Commission to localities was provided for assistance in developing the programs.

THE CRITERIA

In developing their local programs, and regulating development subsequent to adoption of those programs, localities must adhere to a lengthy and detailed listing of "criteria" established by the Commission. The criteria are designed to direct, manage, and control development so that the adverse impacts of growth in the critical area are minimized.

Three types of development areas within the critical area are set forth in the criteria:

- Intensely developed areas.
- Limited development areas.
- Resource conservation areas.

Each local jurisdiction must apply criteria set by the Commission to all lands within the critical area in order to allocate specific parcels to each category. In each jurisdiction development is to be steered away from the critical area. However, when it is proposed in the critical area it is to be directed toward existing intensely developed areas. Additional low intensity development may be permitted but is subjected to strict regulation to prevent adverse environmental impacts. Agriculture and limited resource utilization activities are the primary permitted uses in the resource conservation areas.

The extremely detailed and complex criteria which govern the designation of the three development areas and the management of development therein are far too lengthy for inclusion in this program summary. However, a few key criteria are presented below as examples of the program.

Intensely Developed Areas

To be classified as IDAs, land areas must already have a housing density of four units per acre or more; or, must have concentrated industrial, institutional, or commercial activities; or, have water and sewer service in areas having a housing

density of three units per acre. In addition, these features shall be concentrated in an area of at least 20 adjacent acres, or that entire upland portion of the critical area within the boundary of a municipality, whichever is less. Development within such areas shall be done, at a minimum, with no net increase in pollutant runoff. In some cases "offsets" may be required, with "offsets" being structures or actions that compensate for undesirable impacts. Substantial additional minimum standards must be met.

Limited Development Areas

To be classified as LDAs, land areas must already have a housing density ranging from one unit per 5 acres up to four units per acre; or, be areas not dominated by agriculture, wetland, forest, barren land, surface water, or open space; or, be areas having public water or sewer or both. The overall intensity of development within the LDA must not be increased beyond the level established in a particular area so as to change its prevailing character as identified by density and land use currently established in the area.

All development sites must incorporate a wildlife corridor system that connects the largest undeveloped, or most vegetated tracts of land within and adjacent to the site in order to provide continuity of existing wildlife and plant habitats with offsite habitats. Also, any forest land allowed to be cleared or developed must be replaced on not less than an equal area basis. Substantial additional minimum standards must be met.

Resource Conservation Areas

RCAs are areas characterized by nature dominated environments and must have a housing density less than one unit per acre; or, have as the dominant land use agriculture, wetland, forest, barren land, surface water or open space. Substantial minimum standards focussed on conservation and preservation must be met in this area. Land within the RCA may be developed for residential uses at a density not to exceed one unit per 20 acres, however, the locality must assure that the overall acreage of forest and woodland within the RCA does not decrease.

Other Criteria

Some types of new development and redevelopment are not permitted at all in the critical area unless they can prove their project will result in a net improvement in water quality of adjacent waters. Included in this category are non-maritime heavy industry, transportation and utility facilities (with some exceptions), and permanent sludge handling facilities (with some exceptions). Also, the law authorizes local jurisdictions to preclude any additional development activities which they consider detrimental to water quality or fish, wildlife, or plant habitats within their jurisdiction.

Stormwater quality management is an integral part of the criteria. New development and redevelopment must manage stormwater runoff quality so that there is a ten percent net improvement over predevelopment conditions. Offsets, defined earlier, may be provided either on or off-site, provided that water quality benefits are equivalent, that their benefits are obtained within the same watershed, and that the benefits can be determined through the use of modelling, monitoring, or other computation of mitigation measures.

Lengthy and complex criteria and minimum standards also regulate development in the following areas:

- Water dependent facilities.
- Shore erosion protection works.
- Forest and Woodland protection.
- Agriculture.
- Surface mining.
- Natural parks.
- Habitat Protection Areas.

With regard to the latter, local jurisdictions must establish a 100-foot buffer landward of the mean high water line. With a few minor exceptions, no development may occur in the buffer area, which must be maintained in natural vegetation. Agricultural activities are permitted in the buffer provided a 25-foot setback from mean high water is observed and provided that a lengthy list of other qualifications are met.

CONCLUSION

Although Maryland had a wetlands protection law (administered at the State level by a large staff) and erosion and sediment control law (administered at the State level by a large staff) in effect prior to passage of the Critical Area Law, upland activities were considered to be under-regulated from the standpoint of protecting the quality of the Chesapeake Bay.

Local jurisdiction response to the Act has been mixed. Approximately one-third of the localities subject to the Act completed development of the required land use control programs by the legal deadline of June 11, 1988. Only eight of the sixty jurisdictions identified their "critical area" by the August 1987 deadline. Many of the remaining jurisdictions are near completion of the required programs.[12]

A review of several of the local responses to the Act indicates that extensive use of private consulting services was necessary to complete the documents required by the Act. The State recognized this probability and provided funding to localities to assist in compliance.

Information regarding the impact of the program on resource protection, land values and other factors is not available at this time.

OREGON COMPREHENSIVE PLANNING AND GROWTH MANAGEMENT LAW OF 1973

INTRODUCTION

A desire to conserve the agricultural and forestal nature of rural Oregon led to the passage of the Comprehensive Planning and Growth Management Law of 1973. In 1976 elements specific to the coastal zone were added in response to the Federal Coastal Zone Management Act. The Oregon program is statewide in application and is overseen by a seven member Land Conservation and Development Commission (LCDC). Members are appointed by the Governor. The Law also established a Department of Land Conservation and Development which provides the professional services for implementation of the program.

Three additional groups have formally recognized responsibilities in the program; 1) The Joint Legislative Committee on Land Use, 2) The State Citizen Involvement Advisory Committee, and, 3) The Local Officials Advisory Committee.

The overriding purpose of the Law is to establish consistent local comprehensive plans, statewide, which conform to and incorporate nineteen Goals established by the LCDC. The Goals are mandatory and are supported with advisory Guidelines.

GOALS

The nineteen Goals in the Staewide Planning Program may be assigned to four broad categories:[13]

- Citizen Involvement and Land Use Planning.
- Conservation.
- Development.
- Coastal Resources.

The many goals and guidelines are far too lengthy to repeat in this summary; however, because the focus of this report is the coastal area, some of the Coastal Resources goals are discussed in detail below.

Four widesweeping and detailed goals have been promulgated by the LCDC covering ESTUARINE RESOURCES, COASTAL SHORELANDS, BEACHES AND DUNES, and OCEAN RESOURCES.

ESTUARINE RESOURCES

Comprehensive management programs to recognize and protect the unique environmental, economic, and social values of each estuary and associated wetlands must be developed for all estuaries. The plans are to include "management units" and policies and use priorities for each management unit. At a minimum, three management units are to be defined for each estuary:

- Natural - Areas designated to assure the protection of significant fish and wildlife habitats, of continued biological productivity, and of scientific, research, and educational needs. These must be managed to preserve the natural resources in recognition of dynamic, natural, geological, and evolutionary processes. Permissible uses in this unit are also described.

- Conservation - In all estuaries, except those in the overall Oregon Estuary Classification which are classed for preservation, areas shall be designated for long-term uses of renewable resources that do not require major alteration of the estuary, except for the purpose of restoration. These areas are to be managed to conserve the natural resources and benefits. Permissible uses in this unit are also described.

- Development - In estuaries classified in the overall Oregon Estuary Classification for more intense development or alteration, areas shall be designated to provide for navigation and other identified needs for public, commercial, and industrial water-dependent uses, consistent with the level of development or alteration allowed by the overall Oregon Estuary Classification. Permissible uses are described.

In addition to the goals, lengthy and complex Implementation Requirements and Guidelines have been promulgated by the LCDC.

COASTAL RESOURCES

In this land classification the goals are:

- To conserve, protect, where appropriate, develop and where appropriate restore the resources and benefits of all coastal shorelands, recognizing their value for protection and maintenance of water quality, fish and

wildlife habitat, water dependent uses, economic resources and recreation and aesthetics. The management of these shoreland areas shall be compatible with the characteristics of the adjacent coastal waters; and,

- To reduce the hazard to human life and property, and the adverse effects upon water quality and fish and wildlife habitat, resulting from the use and enjoyment of Oregon's coastal shorelands.

Within this section of the program priorities for land use are issued as are minimum requirements for comprehensive plans, including the designation of coastal shorelands which are to be protected. Areas to be protected include lands within 100 feet of the ocean shore or within 50 feet of an estuary or a coastal lake and areas of significant shoreland and wetland biological habitats whose habitat quality is primarily derived from or related to the association with coastal water areas.

STATE REVIEW OF LOCAL ACTIONS

"During the plan development phase, the law allowed the Commission to issue orders requiring local governments to bring comprehensive plans into compliance with the goals. This power was used only on the most intransigent localities. Generally, the state review involved a cooperative back and forth refinement of the local comprehensive plan.

Beyond the review of local plans, the state has no direct override powers regarding local land use decisions. The state may appeal a decision to a land use court created by the Act."[14]

END NOTES

[1]Hampton Roads Water Quality Agency, Comprehensive Elizabeth River Water Quality Management Plan: Preliminary Management Recommendations, (Norfolk, Virginia: HRWQA, 1986).

[2]Chesapeake Bay Land Use Roundtable, Land Use Initiatives for Tidewater Virginia: The Next Step in Protecting the Bay, (Charlottesville, Virginia: Institute for Environmental Negotiation, 1987).

[3]North Carolina Department of Natural Resources and Community Development - Division of Coastal Management, Striking a Balance: Reflections on Ten Years of Managing the North Carolina Coast, (Raleigh, N.C., 1985), p.3.

[4]North Carolina Department of Natural Resources and Community Development - Division of Coastal Management, Subchapter 7B-Land Use Planning Guidelines, (Raleigh, N.C., Amended 1984).

[5]Ibid. pp 7-17.

[6]North Carolina Department of Natural Resources and Community Development - Division of Coastal Management, A Handbook for Development in North Carolina's Coastal Area, (Raleigh, N.C., 1985), pp. 37-58.

[7]Ibid.

[8]Also Reviewed in preparation of this report was, Conservation Resources in New Hanover County, (New Hanover County, N.C. Planning Department, September 1984).

[9]N.C. DNR and CD, Striking a Balance: Reflections on Ten Years of Managing the North Carolina Coast, 1985, pp. 12-13.

[10]Ibid. pp 28-29.

[11]This summary uses extensive excerpts, both direct and paraphrased, from the Maryland Critical Area Law and the untitled Critical Area Commission document which contains the Law, Program Requirements, and the Criteria.

[12]Also used in developing the summary were:

- The Phipps Group, City of Annapolis - Critical Area Program Appendices, (Annapolis, Maryland: 1987).
- McCrone, Inc., Town of Elkton - Chesapeake Bay Critical Area Protection Program, (Elkton, Maryland: 1987).

- Rogers, Golden & Halpern, et. al., Cecil County - Chesapeake Bay Critical Area Program, (Cecil County, Maryland: 1987).
- Harford County, Harford County - Proposed Chesapeake Bay Critical Area Management Program, (Bel Air, Maryland: 1987).

[13]Land Conservation and Development Commission, Oregon's Statewide Planning Goals - 1985, (Salem, Oregon: Department of Land Conservation and Development, 1985), p.1.

[14]Institute for Environmental Negotiation, "Memorandum to Chesapeake Land Use Roundtable Members", (Charlottesville, Virginia: IEN Staff, 1987).

APPENDIX E

ELIZABETH RIVER CRITICAL MANAGEMENT AREA ALTERNATIVES EVALUATION AND RECOMMENDATION

MEMORANDUM

ELIZABETH RIVER CRITICAL MANAGEMENT AREA ALTERNATIVES EVALUATION AND RECOMMENDATION

"This report was produced, in part, through the assistance of the Southeastern Virginia Planning District Commission."

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Prepared by

HAMPTON ROADS WATER QUALITY AGENCY

January 1989

ELIZABETH RIVER CRITICAL MANAGEMENT AREA ALTERNATIVES

EVALUATION AND RECOMMENDATION

INTRODUCTION

The Comprehensive Elizabeth River Water Quality Management Plan Preliminary Management Recommendations (CERWQMP)[1] included several alternatives for defining a Critical Management Area within the Elizabeth River watershed. While one approach was suggested, none received an overwhelming consensus among the user groups participating in the review process.

The Review of Selected State Land Use and Natural Resource Management Programs (RESLURP)[2] describes several approaches taken by other States to the establishment and assertion of a State role in designating and managing critical environmental areas. That document was prepared as background information in support of this paper, which has as its purposes the following:

- Reevaluation of the Critical Management Area Recommendations from CERWQMP; and,
- Recommendation of a preferred Critical Management Area approach for the Elizabeth River Basin.

In addition to the two reports cited above, numerous other reports, articles and documents were reviewed in preparation of this document. They are cited, as appropriate, in the text.

This review focusses on the relationship between the designation of a Critical Management Area (and attendant management measures) and nonpoint source impacts upon receiving water quality and resources. It does not involve point source management recommendations except as they may be interrelated with nonpoint sources via the pending stormwater point source regulatory program.

The criteria upon which this review is based are simple:

- Does the approach lend itself to definable/observable accomplishment of water quality/resource protection goals; and,
- Does the approach lend itself to implementation through local jurisdiction land use management programs.

Other more discrete criteria are implicitly accounted for in the above.

CERWQMP CRITICAL AREA DETERMINATION

In its discussion and recommendation of alternative approaches to designating a "critical area" for the Elizabeth River, SVPDC considered several options:

- All land and water resources in the Elizabeth River Basin.
- All land resources within a specified distance from the shoreline of the entire river.
- Certain segments of the River (based on observed and projected water quality conditions) and all lands tributary to those segments.
- Certain segments of the River (based on observed and projected water quality conditions) and all land resources within a specified distance from those segments.
- All water and water dependent natural resources of the River and certain critical uses of the land resources of the Basin.

The recommended approach was to designate the entire basin as the critical area with special management attention directed to critical natural resources (wetlands, etc.) and certain land uses (those in transition from low intensity to high intensity use and other high pollutant generators). Mandatory BMP implementation was recommended for new development subject to the Erosion and Sediment Control Law in the entire basin. Further, it was recommended that the requirement for BMP implementation be implemented through the establishment of performance standards for nonpoint source control in local development control ordinances.

The approach based on "all lands a certain distance from a shoreline" was rejected as was the water quality segment cause and effect based approach. The former was rejected because no rational criteria for determining a distance could be determined and the latter because of the unavailability of recent comprehensive monitoring data.

Those conclusions are supported here. In reviewing the North Carolina and the Maryland programs no technically or scientifically rational justification for the distance criteria was evident. In an estuarine situation, where long residence times are a typical occurrence, a nonpoint source discharge in a remote area of a watershed may be as significant as one directly to the estuary. Instead, political rationality explains the motivation for following such approaches. By adversely affecting the economic status quo of a relatively small area and population, acceptance and implementation of those programs was more easily attained.

In the case of Virginia, this matter was discussed by the Chesapeake Bay Land Use Roundtable. While most participants agreed that a watershed-wide approach to nonpoint source management was preferred from the technical standpoint, some felt that political and economic realities would prevent such a geographically large program from being approved by the General Assembly.

On the other hand, past HRWQA recommendations to target pollution clean-up efforts in the Elizabeth River to areas and sources requiring the most attention, based on comprehensive water quality data collected and analyzed in the mid-1970's, have been opposed by some interest groups. That opposition was based on their belief that such an approach would allow, or even promote, environmental degradation in non-targeted areas. With no new comprehensive data set for the Elizabeth River, it is considered unlikely that a locally proposed prioritized segment based approach would be received any more favorably by those interest groups than past attempts to similarly prioritize areas for expenditure of limited clean-up funds. This experience should be considered in the recommendation of a new management approach.

In comparing the SVPDC CERWQMP discussion to the information contained in RESLURP and other reports, it is concluded that the alternatives posed by SVPDC were comprehensive. Most recently, in late November 1988, the Virginia Council on the Environment released a three volume study of environmental management tools used in Virginia and other states.[3] That study was prepared by the Institute for Environmental Negotiation at the University of Virginia. All three volumes of that study have been reviewed by HRWQA. The findings of the Institute researchers were similar to those reported by SVPDC in its earlier work referenced above.

Based on the HRWQA review of the most recently available environmental management research it is concluded that the SVPDC CERWQMP discussion was complete and that HRWQA found no new approaches to critical area definition in the review of other state's programs. However, each state program reviewed took slightly different tacks in the way the options were packaged and in the recommendation of specific implementation steps, tools, and responsibility assignments. In recommending a preferred Critical Management Area approach below, elements from other State's programs are considered.

RECOMMENDED CRITICAL MANAGEMENT AREA APPROACH

The 1988 Virginia Chesapeake Bay Preservation Act (CBPA) requires local jurisdictions in "Tidewater Virginia" to designate "Chesapeake Bay Preservation Areas" based on criteria issued as regulations by the Chesapeake Bay Local Assistance Board (CBLAB). Following designation of the "preservation areas," localities must implement environmental management of those areas in accordance with management criteria issued as regulations by the CBLAB. As of this writing (January 1989), the Chesapeake Bay Local Assistance Department (CBLAD) staff has prepared a draft outline of their proposed area designation criteria. Their proposed

system is resource based, with some distance setback considerations, and includes three zones:

RESOURCE PROTECTION AREAS (RPAs) - Limited use and development.

RESOURCE MANAGEMENT AREAS (RMAs) - Broader use and development.

INTENSIVELY DEVELOPED AREAS (IDAs) - Accommodate in-fill and redevelopment.

RPAs include tidal wetlands, nontidal wetlands adjacent to other RPAs or tributary streams, primary coastal sand dunes, tidal and non-tidal shorelines, including rapidly eroding shorelines and bluffs, and vegetated buffer zones. Definitions for tidal and non-tidal shorelines are not available as of this writing but are obviously crucial in determining the extent of coverage of this area.

RMAs include nontidal wetlands bounded by or adjacent to RMAs or otherwise determined to provide significant water quality benefits, floodplains, highly erodible soils and steep slopes and highly permeable soils.

IDAs are those areas already largely developed.

In addition to the above approach to designating Chesapeake Bay Preservation Areas, the CBLAD staff in their January briefing to the CBLA Board discussed concerns with the scientific defensibility of limiting environmental management to parts of a watershed. It was stated that in addition to the RPA, RMA and IDA area designation approach, they were also developing a watershed-wide based approach to environmental management. The Virginia Institute of Marine Science is assisting them in preparing a guidance document for use by localities opting to take such a broadened area approach to managing environmental quality.

The HRWQA concurs with the CBLAD staffs' preliminary conclusion that a watershed based management program is the most defensible from the water quality perspective. It is recommended that the concept of designating a portion of the Elizabeth River watershed as a "Critical Management Area" be abandoned. That is not to say that prioritization of clean-up efforts and locations should also be abandoned. Limited funds and realities of conditions will always necessitate the targeting of efforts to actions resulting in the most benefit for a given outlay of public funds.

Over the years, attempts to designate parts of the Elizabeth River as "critical" have been interpreted by some interest groups and the media as being veiled attempts to avoid cleaning-up "non-critical" areas. While that interpretation has no basis in fact, countless manhours devoted to explaining the factual intent and content have been entirely unsuccessful.

Consequently, considering the information and experience described above, it is recommended that the comprehensive stormwater quality and environmental management strategy developed by the SVPDC and HRWQA be applied throughout the Elizabeth River Basin, subject to the reasonable availability of financial resources. In the event that a public policy decision is made that such a watershed wide approach is economically infeasible, the less areally extensive 1986 SVPDC CERWQMP approach to critical area management and prioritization should be continued. In either event, changes will likely be necessary to comply with the final approach required by the regulations promulgated by the CBLAB.

POSSIBLE MANGEMENT APPROACHES

In preparing the comprehensive stormwater quality management strategy, consideration of the following management techniques is recommended:

- Implement the Erosion and Sediment Control Program in accordance with the Law.

- Implement the Wetlands, Sand Dunes, and Subaqueous Lands Protection Ordinances in accordance with the Law and guidelines.

- Require Best Management Practices on all new development within the watershed. This should be accomplished through the establishment of performance standards for nonpoint source pollution control in each local jurisdiction's development control ordinances. A model ordinance useful in implementing this approach may be found in the book entitled, Performance Zoning.[4] A very useful method for evaluating the need for BMPs and their attendant effectiveness for application in a performance based approach may be found in the publication, Controlling Urban Runoff: A Practical Manual for Planning and Designing Urban BMPs.[5]

- Require all industries having outside unenclosed storage of materials to install appropriate BMPs based on the performance standards adopted by the respective local jurisdiction.

- Require retrofitting of appropriate BMPs to all traffic zones in the Elizabeth River basin having an average stormwater runoff coefficient equal to or greater than 0.50 as determined following the methodology in WASHCOG's Controlling Urban Runoff: A Practical Manual For Planning and Designing Urban BMPs.[6] That run-off coefficient is proposed based on two complementary factors. First, the Chesapeake Bay Agreement has established a target nutrient reduction goal of 40%. Table 1.5 in the WASHCOG document presents annual storm pollutant export volumes for a range of impervious cover values which closely correspond to runoff coefficients. A review of that Table indicates that an approximate nutrient reduction of 50% could be accomplished, in already developed areas, by

using the 0.50 run-off coefficient. The reduction in zinc and lead would be even greater. It is possible that retrofitting the higher intensity land uses will be more cost-effective since they will have a more modern stormwater collection system, compared to older less dense development patterns.

Independent of the decision to require a BMP program basinwide, local jurisdictions will still have to respond to a state mandate to designate a Chesapeake Bay Preservation Area via application of the criteria developed by the Chesapeake Bay Local Assistance Board. The Chesapeake Bay Preservation Act also authorizes localities to exercise their police and zoning powers to protect water quality (10-320). That authorization will be useful to localities in implementing the recommendations above.

END NOTES

[1]Hampton Roads Water Quality Agency with SVPDC, Comprehensive Elizabeth River Water Quality Management Plan: Preliminary Management Recommendations, (Norfolk, Virginia: HRWQA, 1986).

[2]Hampton Roads Water Quality Agnecy, Review of Selected State Land Use and Natural Resource Management Programs, (Chesapeake, Virginia: HRWQA, 1988).

[3]Institute for Environmental Negotiation, Shoreline Management Options for Virginia Coastal Localities; Planning and Growth Management in Virginia: A Survey of Local Practice; and A Critical Evaluation of Selected Shoreline Management Tools, (Charlottesville, Virginia: University of Virginia, 1988).

[4]Kendig, Lane, Performance Zoning, (Chicago, Illinois: APA, 1980).

[5]Schueler, Thomas R., Controlling Urban Runoff: A Practical Manual for Planning and Designing Urban BMPs, (Washington, D.C.: COG, 1987).

[6]Ibid, p. 1.11.

APPENDIX F

REGIONAL STORMWATER MANAGEMENT STRATEGY

FOR

ELIZABETH RIVER BASIN

STORMWATER MANAGEMENT STRATEGY

ELIZABETH RIVER WATERSHED

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Prepared by

Hampton Roads Water Quality Agency

MAY 1989

INTRODUCTION

The Hampton Roads Water Quality Agency (HRWQA), under contract to the Southeastern Virginia Planning District Commission was retained to assist in the preparation of an Elizabeth River Stormwater Management Plan as well as to assist in the preparation of a similar plan for the entire SVPDC area. The following pages document the Elizabeth River portion of that effort. In this program, HRWQA was to synthesize existing water quality information, assist in the preparation of updated nonpoint source loadings, review prior plan recommendations, evaluate nonpoint source impacts on critical natural resources (as information was available), prepare information on "typical basins", and recommend stormwater management strategies for the "typical basins" as well as the overall Elizabeth River Basin.

Initially, a summary of the water quality condition of the river is presented.

ELIZABETH RIVER WATER QUALITY SUMMARY

Since no new water quality sampling, analysis, or modelling was done as a part of this effort, several prior efforts serve as the base of information for this summary. Generally speaking, all of the sources agree on the basic condition of the river system although some minor interpretational differences have occurred. The sources are:

- Hampton Roads Water Quality Management Plan; Hampton Roads Water Quality Agency, 1978.
- Chesapeake Bay Program, U.S. Environmental Protection Agency; et. al., 1983.
- Background and Problem Assessment Report for the Elizabeth River; SWCB, HRWQA, and SVPDC, 1984.
- The Elizabeth River: An Environmental Perspective; SWCB, 1983.
- Virginia Water Quality Assessment - 1986; 305(b) Report, SWCB, 1986.
- Comprehensive Elizabeth River Water Quality Management Plan-Preliminary Management Recommendations; HRWQA and SVPDC, 1986.
- An Evaluation of the Distribution of Toxicants/Mutagens in the Elizabeth River, Virginia in Relation to Land Use Activities; ODU-AMRL, 1988.
- Elizabeth River 205(j) Water Quality Management Plan-Draft; VWCB, 1988.
- Virginia Water Quality Assessment-1988; VWCB, 305 (b) Report, 1988.

Many other Old Dominion University - Applied Marine Research Laboratory and College of William and Mary - Virginia Institute of Marine Science research papers have been reviewed and provide valuable background information in the preparation of stormwater management plans.

The report cited above entitled, Background and Problem Assessment Report for the Elizabeth River, includes the following statement in Chapter 5 which was prepared by the VWCB:

> "Conclusions presented here are based on comparison of the data base with the Board's Water Quality Standards or criteria, or with EPA's 1976 and 1980 criteria. The data base is extensive enough to draw conclusions regarding traditional water column and sediment pollutants; however, it is extremely inadequate with respect to the distribution and trends of synthetic toxic organics, as well as in the combined impact of these pollutants on the fisheries of the Elizabeth River system. Therefore, in reaching management decisions, more research will be needed to address the toxicity of both the water column and sediments to the fisheries and benthic populations in the Elizabeth River system."

The more recent work completed by the Old Dominion University- Applied Marine Research Laboratory has helped to fill some of the gaps mentioned in the VWCB report quoted above. That new information is useful in making the stormwater management recommendations later in this report.

The water quality problems of the Elizabeth River may be categorized in many different ways, with many sub-aggregations possible. Traditionally, the river has been segmented into the Main Stem and the Eastern, Southern, and Western Branches. Additional categorization of different types of water quality problems may be done, such as conventional pollutants, toxic pollutants , and heavy metals. That categorization may be further subdivided by putting the problem into a specific location such as in the water column (surface, near surface, mid-depth, bottom, etc.), in the benthic environment, or elsewhere. In the summary that follows, all of these categorizations will be included, as appropriate, to try to help focus development of specific stormwater management alternatives for specific water quality problems.

The drainage area of the Elizabeth is only slightly over 500 square kilometers (200 square miles) and lies in the coastal plains province. The highest natural elevation is approximately 20 feet above sea level. There are no free flowing streams, and thus, the inflow of freshwater is limited primarily to stormwater runoff from within the basin although municipal sewage treatment plants discharge a significant amount of "freshwater" on a daily basis. This inflow of naturally occurring freshwater is further limited by the operation of the Deep Creek and

Great Bridge locks. High salinity levels in the upper reaches of all branches are common.

Historically, it is interesting and useful to this effort to observe the long-term nature of problems in the basin. In 1914 the U.S. Public Health Service conducted a bacterial survey of the lower James River and Hampton Roads vicinity. That effort concluded that the harvesting of oysters from the Elizabeth River and its tributaries, for direct marketing, should be prohibited due to high bacteria levels. A 1934 survey reached the same conclusion. A subsequent survey after the construction of sewage treatment plants by the Hampton Roads Sanitation District and the City of Portsmouth showed improved conditions, however, levels remained too high for direct marketing.

The 1975 SWCB 305(b) report observed:

> "The major water quality problem area in the Hampton Roads vicinity is the Elizabeth River complex. For many years, the major use of these waters has been that of receiving wastes generated by heavy industrialization of the surrounding area. It is questionable whether or not this body of water can be restored so that it will provide for the protection and propagation of shellfish, fish, and wildlife, and allow for recreational activities in and on the water by 1983 or in the foreseeable future.
>
> This body of water suffers from many problems including low dissolved oxygen values, high nutrients and sulfur- sulfite values, high bacteriological counts, high heavy metal values, oil spills, creosote leachate, and high temperature cooling water discharges. Most dischargers contribute to more than one problem area.
>
> Heavy traffic on the intracoastal waterway contributes to the fecal coliform and oil spill problems. Heavy yacht traffic, especially during the spring and fall "migration" contributes to peaks in the fecal coliform values."

Tidal mixing is very strong in the river system, however residence times for any given mass of water are quite long. Consequently, pollutants prone to settling out of the water column in a relatively short period of time are able to do so. On the other hand, materials which tend to biodegrade over a relatively short time tend to do so within the system rather than being exported out. Some of these materials exert high oxygen demands in the process of degradation which results in depressed oxygen levels in the water column. Historically, this problem has been exacerbated by the construction of the Craney Island disposal area which has, in effect, resulted

in a lengthening of the Elizabeth River and resulted in longer residence times for pollutants and less opportunity for exportation of them out of the system.

CONVENTIONAL POLLUTANTS

Traditionally, for the purposes of this report, the parameters falling into this category are dissolved oxygen (DO), biochemical oxygen demand (BOD), fecal coliform bacteria, chlorophyll "a" as an indicator of nutrient enrichment, and various species of nitrogen and phosphorus.

Water quality conditions for these parameters in the mid-1970s exhibited fairly consistent locational trends. The closer to the mouth, the better the conditions. Dissolved oxygen levels ranged from good near the mouth to poor in the upper reaches of the Southern Branch and the Eastern Branch. Strong diurnal variation also was observed in the upper reach of the Southern Branch. D.O. levels below 4 mg/l were common at all stations on the Southern and Eastern branches. The only areas exhibiting concentrations consistently above 4 mg/l and average values above 5 mg/l were the Western Branch and the Lafayette River. Also, generally speaking, surface values were better than values observed in the deeper waters. Summarily, dissolved oxygen levels over the last decade were marginal in most areas. However, there is no indication of serious and continuous oxygen depletion and D.O. level trends have been improving.

BOD levels were found to be elevated above typical values for other estuaries in the area throughout the system. Of the range of values observed in the system, the lower values were usually in the deeper areas.

Total nitrogen and total phosphorus concentrations were greatest in the upstream areas and least near the mouth. Algal blooms were observed in the upper reach of the Southern Branch, however observations of chlorophyll "a" throughout the rest of the system ranged from 10 mg/l-20 mg/l which is not considered to be near the level necessary to cause algal blooms in estuarine environments.

Fecal coliform counts were universally high. No areas exhibited levels conducive to collection of oysters for direct marketing.

The 1986 SWCB 305(b) report refers to the report prepared in 1983 by the SWCB, HRWQA, and SVPDC entitled, Background and Problem Assessment Report for the Elizabeth River as the source for recent water quality information. That report concludes that dissolved oxygen and nutrient levels are generally within acceptable ranges with some exceptions. The Southern Branch continues to exhibit the highest percent of observations falling below the average standard of 5 mg/l for disolved oxygen. Nitrogen has not shown any discernable trend in any of the branches. Phosphorus showed a significant decrease over time in the Main Stem and Southern and Western branches. No data for fecal coliform bacteria is cited as having been collected more recently than the mid-1970 information although

individual researchers have undoubtedly done so. It is presumed that levels are still too high to allow direct marketing of harvested oysters and that the State Health Department would not authorize their taking in any event because of the volume of vessel traffic and marine activity. The more recent VWCB 205(j) Report (1988) did not draw conclusions differing from the foregoing. However, the recent ODU-AMRL Report (1988) did note significant release of ammonia and phosphorus from the River sediments. This should be considered when making management recommendations.

While the 1988 VWCB 305(b) Report does not draw conclusions different from the foregoing, the following passage is useful in determining the need for stormwater management in the basin:

> "The Elizabeth River complex receives a wide variety of nonpoint source loadings from its 300 square mile drainage area, in which approximately one-half million people reside. All totaled, such loadings represent a tremendous impact. To complicate matters, the Elizabeth River has very poor flushing characteristics resulting from little freshwater input and a relatively flat topography."

Later in this report, 1985 land use conditions are converted into nonpoint pollutant loadings useful in verifying the above statement.

The Chesapeake Bay Study final report cites the HRWQA data and modeling as its source of information for conventional pollutants and apparently concurs in its conclusions regarding water quality conditions.

From the above summary of trends in conventional pollutant levels, the following conclusions may be drawn and used in the development of management recommendations. Dissolved oxygen levels appear to be stabilized at levels near the state standards, however, very little additional capacity for accepting oxygen demanding substances in the river system is available. BOD is assumed to have remained the same or been reduced by virtue of the fact that the POTW's discharging to the system have been upgraded, no significant new dischargers to the system have come on line since the completion of the mid-1970 studies, and because dissolved oxygen levels have shown a stabilizing trend. With regard to nutrients, phosphorus concentrations are moderately high but this has not generally resulted in excessive algal densities Some attribute this to low nitrogen concentrations and others to light limitations. Since the fecal coliform bacteria levels have been excessive since the early 1900s and since all POTW's and private treatment plant dischargers to the system disinfect, and since the Lamberts Point and Pinners Point POTW's will be combined and disinfection further enhanced, any additional management strategies for this parameter will have to focus on transient, intermittent and nonpoint sources of the parameter.

The Hampton Roads Water Quality Management Plan (1978) included the following conclusion regarding Elizabeth River Water Quality:

> "Water quality problems will persist in the Elizabeth River through the year 1995. The principle problem appears to be nonpoint loads rather than point source effluents. By 1995, it is projected that most point sources will be gone, either through connection to HRSD or by alternative disposal methods.....Because of the reduced (point source) loads and (their) discharge to the river near its mouth, where tidal mixing and flushing are great, the impact of the point sources will not be great. Model runs with no point discharges show only modest changes.....Following the design storm, dissolved oxygen levels will be depressed throughout much of the River.....In addition to large nonpoint loads from both agricultural areas and the urbanized portion of the drainage basin, there are large areas of tidal marshes which are believed to play an important role in controlling water quality in adjacent waters. Bottom sediments also are known to be highly enriched with nutrients. Thus, improvements due to reduced point and nonpoint loads could be masked by the marshes and nutrients released from the sediments."

While not as many point sources have been removed as was anticipated in 1978, the overall conclusions of that study remain valid and unchanged by the research done in the intervening years.

For a more detailed discussion of water quality in the Elizabeth River, including metals and toxics, the reader is directed to the reports listed on page one (1) of this Section.

ELIZABETH RIVER CRITICAL HABITAT AND EXPECTED NONPOINT IMPACT

The purpose of this section is to describe critical aquatic habitat located in the Elizabeth River watershed that may be adversely impacted by nonpoint source (NPS) pollution, including stormwater drainage. For the purposes of this study, five types of critical aquatic habitat have been identified. These include wetlands, submerged aquatic vegetation (SAV) beds, spawning grounds, nursery areas and shellfish beds.

WETLANDS

Wetlands are transitional areas between land and water-based environmental communities. Wetlands found in the Elizabeth River Basin are tidal marshes, tidal mudflats, and non-tidal wetlands. In general, wetlands are characterized by undrained wet soils, vegetation that is adapted to growing in water or saturated

soils, and a periodic covering of shallow water. Tidal wetlands, which are usually vegetated marshes or nonvegetated mudflats, are found along creeks, rivers and bays that are affected by the lunar tide. Nontidal wetlands occur along freshwater streams or lakes, in flood plains or in areas of poor drainage.

Wetlands are extremely productive habitats which provide food and shelter for many resident and migratory species of fish and wildlife. Tidal marshes are particularly productive. Marshes trap nutrients originating from both the land and water and, as a result, produce considerable quantities of plant material. As this plant material dies and decomposes it combines with decomposed animal material to form a material rich in bacteria and microalgae known as detritus. Detritus production is the basis for a major marine food pathway. Once transported by the tide to adjacent waters or mudflats, detritus becomes a rich food source for numerous aquatic organisms. These herbivorous organisms in turn serve as food for higher order carnivores. Because of the highly productive nature of tidal marshes, many species of aquatic organisms use the the waters adjacent to marshes as nurseries. Various species of marine birds, migratory waterfowl and mammals also depend on marsh systems for cover and breeding grounds, and may depend on both marshes and adjacent tidal flats for feeding areas.

Although nontidal wetlands normally do not have the productive value of tidal marshes, they do provide valuable fish and wildlife habitats. Many species of freshwater fish feed in nontidal wetlands or upon wetland produced food. Nontidal wetlands are also used as spawning and nursery grounds by a number of fish species. Even nontidal wetlands that are only seasonally flooded can be important breeding and foraging grounds for some freshwater species of fish. It has also been shown that detritus originating in bottomland hardwood forests can be important to the food chain of estuarine organisms.[1] Nontidal wetlands are also essential breeding, nesting, feeding and shelter habitats for many species of waterfowl, mammals, reptiles and amphibians.

One of the most important values of wetlands is their ability to filter runoff from land before it reaches open water. In doing this, wetlands reduce the adverse effects of nonpoint source pollution by removing and retaining nutrients, breaking down chemicals and organic wastes, and reducing sediment loads. However, the ability of wetlands to perform a pollution control function is limited. Once the limit is exceeded, the productivity of wetlands and their ability to support dependent organisms will deteriorate. This is most likely to occur when stormwater runoff has been concentrated into channels that accelerate the flow of runoff into wetlands. Toxicants such as farm or home use herbicides in runoff may also damage wetland areas.

The Elizabeth River contains an estimated 1845 acres of tidal marsh according to sources at the Virginia Institute of Marine Science (VIMS). Significant areas of non-tidal wetlands are also present in the basin.

SUBMERGED AQUATIC VEGETATION BEDS

Submerged Aquatic Vegetation (SAV) includes all rooted and unrooted underwater plants. Like wetlands, SAV is vitally important to aquatic ecosystems because it serves as cover, food source, spawning ground and nursery area to many species of fish and invertebrates. It also serves to maintain water clarity by filtering and trapping sediments, it acts as a nutrient buffer by accumulating large quantities of nitrogen and phosphorus, and it provides an important source of dissolved oxygen. SAV also serves as the primary food source for many species of migratory waterfowl.

Nonpoint source pollution is thought to be one of the major factors in the nonexistence or drastic decline of SAV beds in many of Southeastern Virginia's water bodies, including the Elizabeth River. Although nutrients are essential to the growth of SAV, the excessive quantities of nutrients often found in urban and agricultural runoff promote algal blooms which cloud the water and limit the ability of SAV to photosynthesize. Excessive sediment loads from runoff compound the problem by combining with algal blooms to further prevent the penetration of sunlight. Without sufficient light, SAV eventually dies and prime aquatic habitat is eliminated.

Little is known about the historic distribution of SAV in the Elizabeth River Basin. Formal SAV surveys conducted since the early 1970s, however, have found no significant concentrations of SAV in the Elizabeth.

SPAWNING GROUNDS

Spawning grounds are those areas in which the eggs of finfish and shellfish are released and larval development occurs. In most species, spawning by the female and the subsequent fertilization of the eggs by the male occur in the same location. In a few species, such as the blue crab, fertilization occurs prior to egg release and the female migrates to the spawning grounds. Most species of marine finfish common to the Elizabeth River spawn and spend most of their lives in the open ocean, but enter estuaries during the summer to feed. Estuarine species of finfish spend their entire lives in estuaries but may migrate to the Chesapeake Bay or the downstream areas of tributaries to spawn. The larvae of both marine and estuarine species are transported from their respective spawning grounds by tides, winds and currents to nursery areas in the upper reaches of tidal estuaries. A number of anadromous and semi-anadromous fish species spawn in the waters of Southeastern Virginia and are likely to utilize portions of the Elizabeth River.

Anadromous fish spend their adult lives in the Atlantic Ocean, but migrate to freshwater estuaries during the spring and early summer to spawn. Anadromous fish common to Southeastern Virginia include american shad, alewife, blueback herring and striped bass. Semi-anadromous fish, such as the white perch, yellow

perch and several species of catfish, live in brackish water estuaries and migrate to freshwater to spawn.

NPS pollution can adversely affect the success of estuarine and marine spawners in several ways. First, the entire spawning process may be impossible if spawning adults are unable to find suitable spawning habitat as a result of dissolved oxygen (DO) depletion from NPS-induced nutrient enrichment. Second, the survival of fertilized eggs and newly hatched larvae requires a proper balance of a number of environmental conditions including sunlight, oxygen, water agitation, salt and chemicals, and water temperature. NPS pollution can disrupt this balance and prevent the hatching of eggs or the survival of larvae. For example, low DO concentrations resulting from nutrient enrichment may harm egg and larval development, or may alter phytoplankton communities thus affecting the type and amount of zooplankton available as food to larvae. Surges of freshwater runoff into estuaries during major storm events may also disrupt the delicate balance required for successful spawning by lowering salinity to levels that threaten the survival of eggs and larvae. A third way in which NPS pollution can affect spawning success is by the introduction of toxic contaminants (pesticides, heavy metals and organic chemicals). Toxics in runoff can be lethal to newly hatched larvae or can induce sublethal effects including changes in swimming, feeding and predator avoidance.

As mentioned above, many of the species of marine fish common to the Elizabeth River spawn in the open ocean. However, several estuarine species which are year long residents of the Bay and its tributaries spawn in the lower Chesapeake Bay/Hampton Roads/lower James River area. Some of these species are resident to these waters, while others migrate from upstream tributaries. Estuarine species include bay anchovy, gobies, killifish, silversides and hogchoker. Although not commercially important, these fish are important forage species for marine finfish that enter estuaries during the summer to feed. The exact locations of the spawning areas for these fish will depend on a number of factors including salinity, water temperature, and bottom characteristics. At least two species of forage fish depend on abandoned shells for spawning. The killifish spawns during a spring tide depositing its eggs in shells above the normal high tide line. The eggs then hatch during the next month's spring tide. Gobies spawn from May to October by forming nests and laying eggs in dead oyster shells. Males then guard the nest until the eggs hatch. The interdependence of fish reproduction and SAV is illustrated by the silverside. Silversides spawn in the early spring. Their eggs have adhesive filaments which attach themselves to grasses where they remain until they are hatched.

The blue crab spawns in an area along the south side of the mouth of the Chesapeake Bay. Spawning occurs from mid-spring through summer. To protect spawning blue crabs, a 130 square mile "crab sanctuary" has been designated in which harvests are prohibited between June 1 and September 15. The extent to which crabs may spawn in the Elizabeth River is not known.

The upper reaches of the Elizabeth River are probably spawning grounds for several species of anadromous and semi-anadromous finfish. Because spawning locations depend on the right balance of a number of environmental conditions which may vary from season to season (i.e., salinity, water temperature, water depth, turbidity, circulation and bottom type), it is impossible to identify specific spawning grounds. Table 1 summarizes the general environmental conditions for and the environmental constraints to successful spawning of anadromous and semi-anadromous fish found in Southeastern Virginia.

TABLE 1

ENVIRONMENTAL CONDITIONS FOR SPAWNING OF COMMON ANADROMOUS AND SEMI-ANADROMOUS FISH IN SOUTHEASTERN VIRGINIA

Species	Temperature (°C) and Salinity Conditions	Spawning Areas	Spawning Season	Environmental Constraints
Anadromous				
Alewife	Water temperature: minimum 10.5; peak 18; maximum 29-31. Salinity: Freshwater to salinities less than 0.5 ppt.	Large rivers, small streams and ponds over detritus-covered bottom with vegetation; sometimes at depths about 3 m. Usually ascend streams further than blueback herring.	Late March through April with spawning lasting only a few days for each spawning group.	Usually spawn in sluggish water 15-30 cm deep. The greatest spawning activity occurs at night.
American Shad	Water temperature: minimum 8; peak 17; (Spawning generally occurs at 12°-21°C). Salinity: Tidal-freshwater to 0.5 ppt.	Primarily in tidal-fresh water of rivers with areas of extensive flats; also over sand or pebbly bottom; often near mouths of creeks.	April - May Mid-May and July	Currents less than 0.3 or greater than 0.9 m sec^{-1}; depths of 0.9-12.2 m; eggs absent at less than 5 ppm oxygen.
Blueback Herring	Water temperature: minimum 14; peak 21-26; maximum 27. Salinity: Fresh to brackish waters.	Fresh and brackish rivers and tributaries, never far above tidewater; over bottoms of clean swept sand and gravel to boulders.	April - May	Areas of relatively wide and deep ingress with swift flow.
Striped Bass	Water temperature: minimum 11; peak 14-19; maximum 23. Salinity: Freshwater to salinity less than 3 ppt.	Large rivers and the upper portion of the Bay; spawning is concentrated within the first river kilometer above salt water.	Spawning occurs from the beginning of April through mid-June.	A minimum current of 30 cm sec^{-1} is needed to keep eggs in suspension; optimal currents are 1 - 2 m sec^{-1}. Maximum survival of eggs before water hardening occurs at about 1 ppt salinity.

TABLE 1 (Continued)
ENVIRONMENTAL CONDITIONS FOR SPAWNING OF COMMON ANADROMOUS AND SEMI-ANADROMOUS FISH IN SOUTHEASTERN VIRGINIA

Species	Temperature (°C) and Salinity Conditions	Spawning Areas	Spawning Season	Environmental Constraints
Semi-Anadromous				
White Perch	Water temperature: minimum 7.2-10; peak 11-16; maximum about 20, Salinity: Freshwater to 4 ppt.	Fresh, tidal fresh, or slightly brackish water in rivers, tributary streams, and shallow coves.	Late March to early June: eggs are not released all at once, and ovulation may continue for 10 to 21 days.	A sudden drop in temperature of 2.2 to 2.8°C may kill eggs.
Yellow Perch	Water temperature: minimum 5; peak 8.5-11; maximum 23. Salinity: Freshwater to 2.5 ppt.	Tidal or non-tidal portions of rivers near shore, over substrates of sand, rock, gravel or rubble; typically at depths of 1.5 to 3 m.	Spawning occurs from the end of February to April, with peak activity in mid-March.	Significant growth reduction at 2.0 ppm dissolved oxygen.
White Catfish	Water temperature: peak about 21. Salinity: Freshwater.	Still or running water; nests usually built near sand or gravel banks.	Late May	No information
Brown Bullhead	Water temperature: peak 21-25. Salinity: Freshwater.	Sluggish, weedy, muddy streams and lakes; nests occur in shelter of logs, rocks, or vegetation.	Early April to August throughout the range.	Spawning occurs in early morning to early afternoon. Eggs exposed to sunlight have poor hatching success.
Channel Catfish	Water temperature: minimum 21; peak 27; maximum 29. Salinity: Freshwater to 2ppt.	Nests occur in weedy areas near lake shores, in protected sites, small streams, sometimes in very swift water.	March through July, possibly September; sometimes have two spawning peaks per season.	Growth reduction at less than 3.5 ppm dissolved oxygen.

Source: Environmental Protection Agency, Chesapeake Bay: A Profile of Environmental Change, Appendix C (Philadelphia, Pennsylvania: EPA, 1985).

NURSERY AREAS

Nursery areas are those aquatic habitats where the initial growth and development of finfish and shellfish occurs. Nursery areas for finfish are usually shallow, have organic bottom types and, as previously mentioned, are often dependent on SAV beds or wetlands for nourishment. Fish larvae of marine species are produced in the open ocean and are transported by tides, winds and currents to nursery grounds in less saline, upstream areas of tidal rivers, creeks and bays. The larvae of estuarine species of finfish, and the bluecrab, may remain in the Bay or be transported from the Bay or the downstream portions of its tributaries to upstream nurseries. The larvae of anadromous and semi-anadromous fish are transported in the opposite direction from the freshwater headwaters of estuaries to nursery areas in more saline, downstream areas. As mentioned previously, freshwater fish usually nurse their young in nests found along the shoreline. The locations of nursery areas for individual species of finfish are determined by salinity levels and the presence of food sources.

In the case of shellfish species such as the commercially important eastern oyster and hard clam, nursery areas are located in already established shellfish beds. Oyster larvae are initially pelagic but eventually attach themselves to hard substrate, usually existing oyster shells. Hard clam larvae are also initially pelagic, but, during the later stages of the larval stage, they alternate between a planktonic and benthic existence occasionally attaching themselves to firm substrate. By the time they reach the juvenile stage, they have burrowed permanently in soft substrate.

Nursery areas have been identified as critical habitat because the early life stages of shellfish and finfish are more sensitive to the adverse affects of NPS pollution than adult organisms. NPS pollution may adversely affect nursery areas in the following ways:

- Nutrient enrichment may cause algal blooms which may depress DO levels and/or cause the disappearance of SAV beds.
- Toxics carried in runoff may have lethal or sublethal affects on juvenile populations.
- Wetlands loss due to runoff may lead to the disappearance of suitable nursery habitat.
- Turbidity resulting from excessive sediment loads in runoff may cause a rise in water temperature to a point that threatens juvenile populations.
- Sediment suspended in turbid water may clog the gills of juvenile fish or the gills of invertebrates that are their food sources.

- Excessive quantities of freshwater runoff may decrease salinity levels to a point where juvenile populations are threatened.

It is impossible to identify specific locations of estuarine and marine fish nurseries in the Elizabeth River because schools of juveniles relocate frequently in response to a number of factors including salinity, temperature, time of day, food supply and oxygen levels. Also, the juveniles of many species migrate gradually downstream as they mature. In general, however, the nursery areas of most species are associated with certain ecological zones defined by salinity levels. These zones and their corresponding salinity ranges are as follows: polyhaline (16.5 - 30.0 ppt), mesohaline (3.0 - 16.5 ppt), oligohaline (0.5 - 3.0 ppt) and freshwater (less than 0.5 ppt). Salinity regimes migrate with the tides, freshwater inflow and weather conditions.

There is little information available regarding the extent to which the Elizabeth River is used as a fish nursery area. During several fish surveys conducted during 1973 and 1974 in the Elizabeth River, a number of species of marine, estuarine, anadromous and semi-anadromous fish were taken, most of which were juveniles or young-of-the-year.[2] The results of these surveys are a strong indication that the Elizabeth River is used, at least to some degree, as a fish nursery.

Shellfish Beds

The National Shellfish Sanitation Program Manual defines shellfish as "all edible molluscan shellfish species of oysters, clams and mussels".[3] Commercially important shellfish species harvested in Southeastern Virginia include the eastern oyster and the hard clam. Shellfish are immobile bottom dwellers that are generally found in densely populated beds. Oyster beds are found on firm bottom surfaces in relatively shallow (less than 8 - 10 meters) water with relatively low salinity. A firm substrate is required to support the massive and heavy clusters of oysters found in a bed.

Unlike the oyster which attaches itself to hard bottom surfaces, the mature hard clam burrows in penetrable bottom sediment. Hard clams require slightly higher salinities than the oyster and can be found anywhere from intertidal mudflats to depths of 10 meters or more. Hard clams, especially juveniles, are important food sources for a number of fish, crabs, waterfowl and marine birds.

Oysters and hard clams are particularly susceptible to NPS pollution because they are immobile and unable to escape unfavorable water quality conditions. Sediment carried in runoff can blanket and suffocate oyster and clam beds. Sediment may also eliminate the hard, clean surfaces required for the attachment of oyster larvae. In addition, excessive nutrient loads in runoff may significantly lower DO levels. Low DO can severely stress shellfish populations thus lowering disease resistance and reproductive success. In cases of sustained DO depletion, entire beds may be eliminated. Shellfish may also be susceptible to toxics contained

in NPS pollution. Contamination of bed sediments and overlying water by toxics can adversely affect the physiological processes of shellfish and possibly make them unfit for human consumption. Frequent freshwater discharge from stormwater runoff is another limiting factor to the survival of shellfish populations. Such discharges may result in long term reduction in salinity levels which could either eliminate shellfish populations or lower their resistance to disease and predation. Finally, shellfish may ingest and concentrate bacteria that is harmful to humans contained in urban runoff. Bacterial contamination and the automatic condemnation of shellfish grounds near marinas and point source discharges are the reasons why the entire Elizabeth River is closed to shellfish harvesting. Also, the State Division of Shellfish Sanitation (SDSS) has condemned clam grounds near the mouth of the Elizabeth River because of pollutants emanating from it as a result of tidal action.

Figure 1 shows the general locations of public and privately leased oyster grounds in the lower James River, Hampton Roads (including the Elizabeth River) and the lower Chesapeake Bay.

Public oyster grounds and private leases are still delineated by the VMRC in the Elizabeth River. Given the magnitude of pollution problems and the large number of automatic condemnation areas, however, there is little likelihood that shellfish grounds in most of these water bodies will ever be reopened. The discharges that have resulted in the condemnation of the River's shellfish areas come from both point source and nonpoint sources. These sources include the discharges noted above which require automatic condemnation as well as animal feed lot discharges, leaking septic tanks and stormwater runoff.

The Elizabeth River contains approximately 1,477 acres of currently leased shellfish grounds and approximately 3,621 acres of public grounds. As mentioned earlier, all of that acreage is condemned.

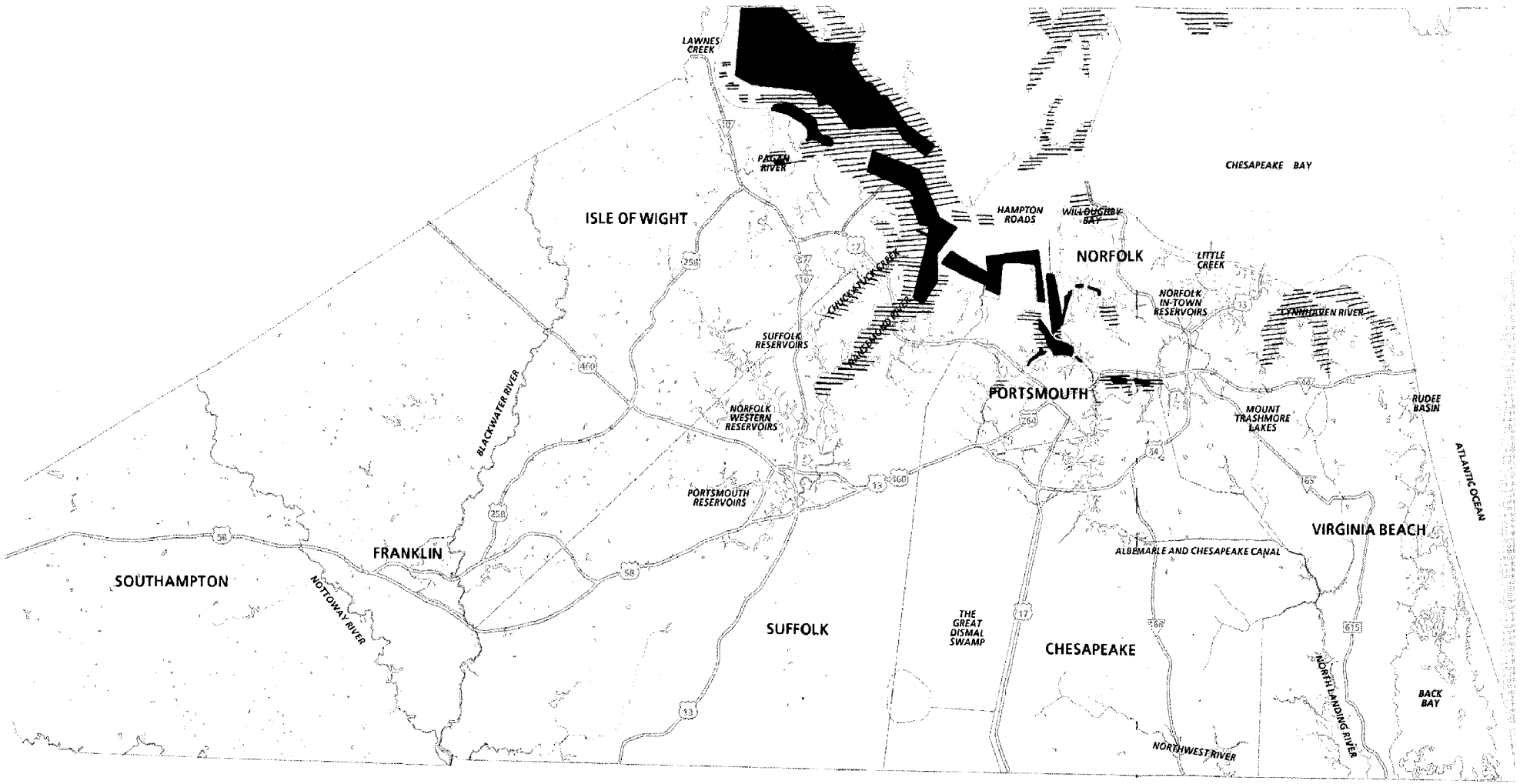


FIGURE 1
PUBLIC AND PRIVATE OYSTER GROUNDS IN SOUTHEASTERN VIRGINIA

PREPARED BY SVPDC 1989
SOURCE: State Water Control Board.

NONPOINT SOURCE LOADINGS UPDATE-ELIZABETH RIVER BASIN

With the primary purpose of this study being the development of a stormwater management plan for the Elizabeth River watershed, updated nonpoint source loading projections were needed.

Also, in order to develop the recommended stormwater management programs for typical drainage basins (to be discussed later), as well as for the overall Elizabeth River watershed, it was necessary to gain an understanding of the magnitude of NPS pollution associated with various types and mixes of land uses. This was done by estimating the annual NPS loadings for specific pollutants for all of the third order drainage basins making-up the Elizabeth River watershed. A map of the Elizabeth River watershed and third order drainage basins is shown as Figure 2.

NPS loadings were estimated for conventional pollutants; 5-day biochemical oxygen demand, total suspended solids and fecal coliform, nutrients (total phosphorus and total nitrogen), and metals (lead and zinc). The land use categories for which loadings were estimated include commercial/institutional, light industry, heavy industry, low density residential, high density residential, agriculture, open and undeveloped, and water. The loading factors used in this analysis were derived from sampling and computer modelling work done in previous studies for the Hampton Roads area, Northern Virginia and the Chesapeake Bay. Factors used for each pollutant parameter and land use are shown in Table 2. Except where otherwise noted, all factors are expressed in pounds per acre per year.

A number of other NPS pollutants, which may result in significant water quality problems, were not included in this analysis. These include copper, tin, polynuclear aromatic hydrocarbons and other organic substances. Local loading factors have not been developed for these pollutants due to a lack of extensive sampling data and to the site-specific nature of their discharges. Furthermore, NPS loading estimates were not generated for certain site-specific activities and land uses which are known to be significant sources of NPS pollution. These include construction and outside material storage sites. Construction-related loadings could not be estimated because they are sporadically located and short-term in duration. Also, impacts from construction site runoff tend to be localized. Loadings from outside storage sites cannot be generalized because they represent a wide variety of types and amounts of pollutants depending on site characteristics and the nature of the stored material. Consequently, the NPS loadings calculated for this study tend to understate the region's NPS pollution problem. This should be considered when actual site specific BMP plans are being prepared, especially for areas undergoing construction activity.

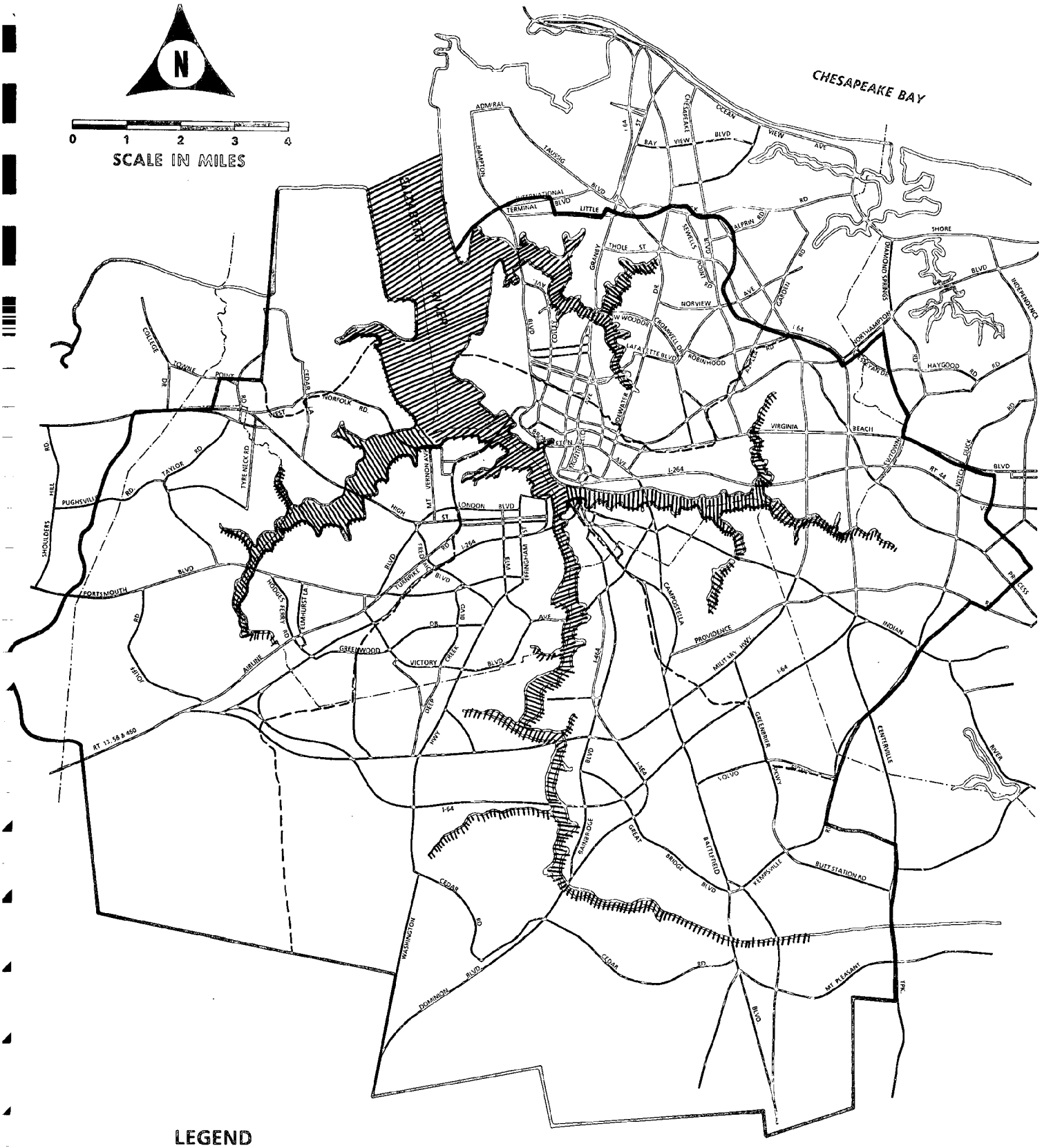


FIGURE 2
ELIZABETH RIVER WATERSHED

PREPARED BY SVPDC 1989

TABLE 2
NONPOINT SOURCE LOADING FACTORS BY LAND USE CATEGORY

Parameter	Commercial/ Institutional	Light Industry/ Streets	Heavy Industry	Low Density Residential	High Density Residential	Agricultural	Vacant	Water
BOD	37.4(E)	21.8(A)	21.8(A)	18.7(A)	36.3(A)	45.0(F)	1.7(A)	-
TSS	0.294(E)	0.167(A)	0.167(A)	0.145(A)	0.255(A)	3.6(F)	0.012(A)	-
Fecal Coliform	153.9(E)	53.5(A)	53.5(A)	87.1(A)	361.4(A)	-	1.0(A)	-
Total P	1.53(E)	0.86(A)	0.86(A)	0.75(A)	1.34(A)	1.04(D)	0.05(A)	0.70(B)
Total N	15.1(E)	8.6(A)	8.6(A)	7.4(A)	13.2(A)	9.10(D)	0.6(A)	1.6(B)
Lead	2.17(E)	1.77(C)	1.77(C)	0.24(C)	0.67(C)	0.04(F)	0.02(C)	0.02(C)
Zinc	1.53(E)	1.40(C)	1.40(C)	0.18(C)	0.33(C)	0.22(F)	0.02(C)	0.02(C)

Notes:

1. All factors expressed in pounds per acre per year, except as otherwise noted.
2. BOD is 5-day Biochemical Oxygen Demand.
3. Total suspended solids, (TSS) expressed as Factor x 10^3.
4. Fecal coliform bacteria as 10^9 cells.
5. Total Phosphorus.
6. Total Nitrogen.
7. Fecal Coliform loading rates for agricultural land, and BOD, TSS and Fecal Coliform loading rates for water were not developed for previous studies.

Sources:

(A) Hampton Roads Water Quality Management Plan.
(B) EPA Chesapeake Bay Basin Model, reported in CDM, Water Quality Management Plan for Skiffe's Creek Reservoir Watershed.
(C) EPA Washington D.C. NURP Study, reported in CDM.
(D) State Water Control Board, Chowan Basin Nutrient Control Plan for Virginia.
(E) SVPDC, 1986. Based on average of loading rates for Commercial Strip.
(F) State Water Control Board, Chowan River Basin 208 Project.

The land use data used to estimate loadings were obtained from SVPDC's 1985 Transportation Data Report (TDR). Jurisdictions having land in the Elizabeth River watershed include the cities of Chesapeake, Norfolk, Portsmouth and Virginia Beach. To be of use to this study, the TDR data base had to be modified in two ways. First, the TDR data were aggregated to the third-order drainage basin level. The TDR data base was initially established for transportation planning purposes and was therefore compiled for Statistical Areas (SAs). Unfortunately, SA boundaries were drawn to correspond to census tract and jurisdictional boundaries and not to drainage basin boundaries. It was therefore necessary to split and assign portions of some SAs to drainage basins. For each SA that required splitting, the percentage of the SA assigned to each drainage basin was determined. These percentages were then used to proportion and allocate SA land use totals to the appropriate drainage basins. Once the TDR land use data were compiled at the third-order drainage basins level, it was necessary to consolidate TDR land use categories in order that they match the categories for which the selected loading factors were developed. The methodology used in this consolidation process is shown in Table 3.

The NPS pollutant loads for each of the third order drainage basins making-up the Elizabeth River watershed are shown on Table 4. Table 5 summarizes land use data for the third order basins.

TABLE 3

METHODOLOGY FOR CONSOLIDATING TDR LAND USE CATEGORIES

Use Categories Used in NPS Loading Analysis	Consolidation of TDR Use Categories
Light Industrial	Manufacturing (2&3) + Trans. Comm. Util. (4) - SAs along Elizabeth R.
Heavy Industry	All subtracted items above.
Commercial/Institution	Trade (5) + Services (6) - Cemeteries (624)
Low Density Residential	Residential (1) (1-7 DU/acre)
High Density Residential	Residential (1) (>7 DU/acre)
Agriculture	Resource Prod. Ext. (8)
Open Space & Undeveloped	Undev. (9) + Cemetery (624) + Cult. Ent. & Rec. (7) - Water (93)

* All numbers in parentheses refer to Standard Land Use Code categories as used in the SVPDC Transportation Data Report (TDR).

TABLE 4
NONPOINT SOURCE LOADINGS ELIZABETH RIVER BASIN
(Based on 1985 Land Use)

WILLOUGHBY BAY POLLUTANT LOADS

Parameter	Commercial/ Institutional	Light Industry	Heavy Industry	Low Density Residential	High Density Residential	Agricultural	Undeveloped	Water	Total
BOD	83,826.12	34,569.57	30,261.89	22,992.21	33,318.10	0.00	2,652.27	0.00	207,620.16
TSS	658,950.00	264,820.00	231,820.00	178,280.00	234,050.00	0.00	18,720.00	0.00	1,586,660
Fecal Coliform	344,942.23	84,838.16	74,266.56	107,092.06	331,712.44	0.00	1,560.16	0.00	944,411.60
Total P	3,429.25	1,363.75	1,193.82	922.15	1,229.92	0.00	78.01	321.33	8,538.24
Total N	33,844.23	13,637.54	11,938.18	9,098.52	12,115.67	0.00	936.10	734.48	82,304.72
Lead	4,863.71	2,806.80	2,457.04	295.09	614.96	0.00	31.20	9.18	11,077.98
Zinc	3,429.25	2,220.06	1,943.42	221.32	302.89	0.00	31.20	9.18	8,157.33

LAFAYETTE RIVER POLLUTANT LOADS

BOD	52,422.46	48,502.60	5,968.84	46,630.13	78,791.40	9.00	1,641.45	0.00	233,965.89
TSS	412,090.00	371,560.00	45,720.00	361,570.00	553,490.00	720.00	11,590.00	0.00	1,756,740.00
Fecal Coliform	215,717.01	119,031.61	14,648.30	217,191.69	784,441.11	0.00	965.56	0.00	1,351,995.28
Total P	2,144.56	1,913.41	235.47	1,870.19	2,908.55	0.21	48.28	1,814.86	10,935.52
Total N	21,165.22	19,134.05	2,354.68	18,452.57	28,651.42	1.82	579.34	4,148.26	94,487.35
Lead	3,041.62	3,938.06	484.63	598.46	1,454.28	0.01	19.31	51.85	9,588.22
Zinc	2,144.56	3,114.85	383.32	448.85	716.29	0.04	19.31	51.85	6,879.06

TABLE 4 (Continued)
NONPOINT SOURCE LOADINGS ELIZABETH RIVER BASIN
(Based on 1985 Land Use)

EASTERN BRANCH POLLUTANT LOADS

Parameter	Commercial/ Institutional	Light Industry	Heavy Industry	Low Density Residential	High Density Residential	Agricultural	Undeveloped	Water	Total
BOD	162,017.66	93,395.12	28,547.97	135,800.90	60,397.94	14,463.45	8,414.78	0.00	503,037.82
TSS	1,273,610.00	715,460.00	218,690.00	1,053,000.00	424,280.00	1,159,080.00	59,400.00	0.00	4,901,530
Fecal Coliform	666,698.34	229,203.63	70,060.39	632,527.17	601,317.20	0.00	4,949.97	0.00	2,204,756.59
Total P	6,628.00	3,684.39	1,126.20	5,446.56	2,229.57	334.27	247.49	1,931.61	21,628.09
Total N	65,413.55	36,843.95	11,262.04	53,739.39	21,962.89	2,924.83	2,969.92	4,415.12	199,531.69
Lead	9,400.49	7,583.00	2,317.89	1,742.90	1,114.78	12.86	99.00	55.19	22,326.10
Zinc	6,628.00	5,997.85	1,833.36	1,307.17	549.07	70.71	99.00	55.19	16,540.35

SOUTHERN BRANCH POLLUTANT LOADS

BOD	132,359.31	110,920.14	75,104.27	176,667.02	41,258.40	177,570.81	55,720.97	0.00	769,600.92
TSS	1,040,470	849,710.00	575,340.00	1,369,880.00	289,830.00	14,205,660.00	393,320.00	0.00	18,724,220.00
Fecal Coliform	544,655.02	272,212.28	184,315.53	822,871.50	410,765.43	0.00	32,777.04	0.00	2,267,596.80
Total P	5,414.70	4,375.75	2,962.83	7,085.58	1,523.04	4,103.86	1,638.85	1,775.94	28,880.54
Total N	53,439.19	43,757.49	29,628.29	69,911.01	15,003.05	35,908.76	19,666,22	4,059.28	271,373.30
Lead	7,679 67	9,005.90	6,097,92	2,267.38	761.52	157.84	655 54	50.74	26,676.51
Zinc	5,414.70	7,123.31	4,823.21	1,700.54	375.08	868.12	655.54	50.74	21,011.24

TABLE 4 (Continued)
NONPOINT SOURCE LOADINGS ELIZABETH RIVER BASIN
(Based on 1985 Land Use)

WESTERN BRANCH POLLUTANT LOADS

Parameter	Commercial/ Institutional	Light Industry	Heavy Industry	Low Density Residential	High Density Residential	Agricultural	Undeveloped	Water	Total
BOD	55,935.59	58,935.65	15,363.55	138,771.47	14,296.39	241,416.90	20,425.04	0.00	545,144.58
TSS	439,710.00	451,480.00	117,690.00	1,076,040.00	100,430.00	19,313,360.00	144,180.00	0.00	21,642,880.00
Fecal Coliform	230,173.46	144,635.65	37,704.13	646,363.35	142,333.78	0.00	12,014.73	0.00	1,213,225.08
Total P	2,288.27	2,324.98	606.09	5,565.70	527.75	5,579.41	600.74	1,671.01	19,163.95
Total N	22,583.62	23,249.84	6,060.85	54,914.91	5,198.69	48,819.86	7,208.84	3,819.46	171,856.07
Lead	3,245.46	4,785.14	1,247.41	1,781.02	263.87	214.59	240.29	47.74	11,825.54
Zinc	2,288.27	3,784.86	986.65	1,335.77	129.97	1,180.26	240.29	47.74	9,993.82

CRANEY ISLAND CREEK POLLUTANT LOADS

BOD	37,680.13	1,715.88	487.23	8,868.10	199.65	0.00	5,845.84	0.00	54,796.83
TSS	296,200.00	13,140.00	3,730.00	68,760.00	1,400.00	0.00	41,260.00	0.00	424,510.00
Fecal Coliform	155,052.71	4,210.99	1,195.73	41,305.43	1,987.70	0.00	3,438.73	0.00	207,191.28
Total P	1,541.46	67.69	19.22	355.67	7.37	0.00	171.94	3,450.86	5,614.21
Total N	15,213.10	676.91	192.21	3,509.30	72.60	0.00	2,063.24	7,887.68	29,615.04
Lead	2,186.25	139.32	39.56	113.82	3.69	0.00	68.77	98.60	2,650.00
Zinc	1,541.46	110.19	31.29	85.36	1.82	0.00	68.77	98.60	1,937.49

Explanatory Notes:

1. All loadings are expressed in pounds per year, except where otherwise noted.
2. The light industry land use acreage also includes all streets and highways.
3. BOD is 5-day Biochemical Oxygen Demand.
4. Fecal Coliform is expressed as 10^9 Cells.
5. Total P = Total Phosphorus.
6. Total N = Total Nitrogren.
7. BOD, TSS and Fecal Coliform loadings were not calculated for water

TABLE 5
ELIZABETH RIVER BASIN
1985 LAND USE

Basin	Commercial/ Institutional	Light Industry	Heavy Industry	Low Density Residential	High Density Residential	Agricultural	Undeveloped	Water	Total
Willoughby Bay	2,241.34	1,585.76	1,388.16	1,229.53	917.85	0.00	1,560.16	459.05	9,381.85
Lafayette River	1,401.67	2,224.89	273.80	2,493.59	2,170.56	0.20	965.56	2,592.66	12,122.93
Eastern Branch	4,332.02	4,284.18	1,309.54	7,262.08	1,663.86	321.41	4,949.87	2,759.45	26,882.41
Southern Branch	3,539.02	5,088.08	3,445.15	9,447.43	1,136.60	3,946.02	32,777.04	2,537.05	61,916.39
Western Branch	1,495.60	2,703.47	704.75	7,420.93	393.84	5,364.82	12,014.73	2,387.16	32,485.3
Craney Island Creek	1,007.49	78.71	22.35	474.23	5.50	0.00	3,438.73	4,929.80	9,956.81
Total	14,017.14	15,965.09	7,143.75	28,327.79	6,288.21	9,632.45	55,706.09	15,665.17	152,745.69

Source: SVPDC, Transportation Data Report, 1986.

DISCUSSION OF ESTIMATED NPS POLLUTANTS LOADINGS

The following generally describes, for each pollutant analyzed, those land uses and third order drainage basins which produce high NPS loadings.

Biochemical Oxygen Demand (BOD)

High BOD loading estimates are generally associated with agricultural as well as mixed, high density urban use. Intensely developed urban basins which produce high BOD estimates include those surrounding the Lafayette River, and the Eastern, Western, and Southern Branches of the Elizabeth River.

Total Suspended Solids (TSS)

Suspended Solids in stormwater runoff are generally associated with the erosion that occurs as a result of construction and agricultural activities, although intensely developed areas are significant contributing sources. In comparison to other sources of TSS in the watershed, as shown later, runoff-borne levels are quite high.

Fecal Coliforms

High fecal coliform loadings are associated with almost all watersheds and land uses. Experience around the Chesapeake Bay has shown that as areas develop, fecal coliform levels increase which results in an increase in the number of shellfish grounds condemned for direct market harvesting. This is certainly true of all of the Elizabeth River watersheds.

Total Phosphorus and Total Nitrogen

Total phosphorus and total nitrogen NPS loadings are generally associated with fertilizer use, however, high levels may also be found in urban areas. Recent literature increasingly suggests that atmospheric sources (air pollution) are also a substantial contributor. Due to the high degree of imperviousness, areas having concentrations of suburban and urban development may have a higher a per acre loading rate than agricultural use. Therefore, basins with significant commercial/institutional and high density residential uses, including all of the Elizabeth River watersheds, have the highest estimated loadings for these parameters.

Lead and Zinc

Lead and zinc loads in urban runoff are primarily generated by motor vehicles. Basins with a large amount of traffic-generating land use, such as commercial/institutional and industrial, will therefore produce the highest loading

estimates. The Elizabeth River watersheds therefore are significant contributors of these parameters.

COMPARISON OF NONPOINT SOURCE LOADINGS AND SEWAGE TREATMENT PLANT DISCHARGES

In order to demonstrate the magnitude of the NPS pollution problem, a comparison was made of estimated NPS loadings from the Elizabeth River Basin and discharges from the three sewage treatment plants currently discharging to the Elizabeth River (Pinners Point, Lamberts Point, and Army Base STPs). Also, a comparison was made of the estimated loadings to a single well operated STP; the HRSD Army Base STP. Since the Pinners Point and Lamberts Point STPs will be combined and achieve a much higher degree of pollutant removal in the near future, these comparisons may be considered conservative. That is, in the future, the nonpoint source loading as a percent of the total loading to the basin will be greater than it is today.

Estimated NPS loadings for the Elizabeth River Basin and the land use totals from which they were derived are shown in Tables 4 and 5.

The factors used to calculate pollutant loadings for the sewage treatment plants are based on actual operational characteristics obtained from the Hampton Roads Sanitation District. Loading factors for fecal coliform were not developed because the chlorination process found in all STPs virtually eliminates this pollutant. These loadings are compared to estimated NPS loadings in the Elizabeth River basin in Figures 3 and 4.

As can be seen from the loading comparison tables, nonpoint sources contribute significantly to overall pollutant loadings, and in some cases are the most significant contributor of the two types of sources. It must be pointed out here, however, that atmospheric and benthic release sources are not included in this analysis. The recent ODU-AMRL report referenced earlier suggests the latter may be significant, as did the 1978 HRWQMP. Of course, sediment release of nutrients is largely, if not totally, uncontrollable.

The preceding analysis illustrates the extent to which NPS pollution can contribute to total pollutant loadings. The degree of water quality degradation attributable to NPS pollution will depend on the specific land and water characteristics of individual drainage basins. However, as HRWQA concluded in the 1978 Hampton Roads Water Quality Management Plan (HRWQMP), even if all the point sources discharging to the Elizabeth River were removed, nonpoint and other sources would still prevent attainment of some water quality standards in the River.

FIGURE 3
ELIZABETH RIVER WATERSHED ANNUAL NONPOINT SOURCE POLLUTANT LOADS
COMPARED TO HRSD ARMY BASE STP ANNUAL LOADS

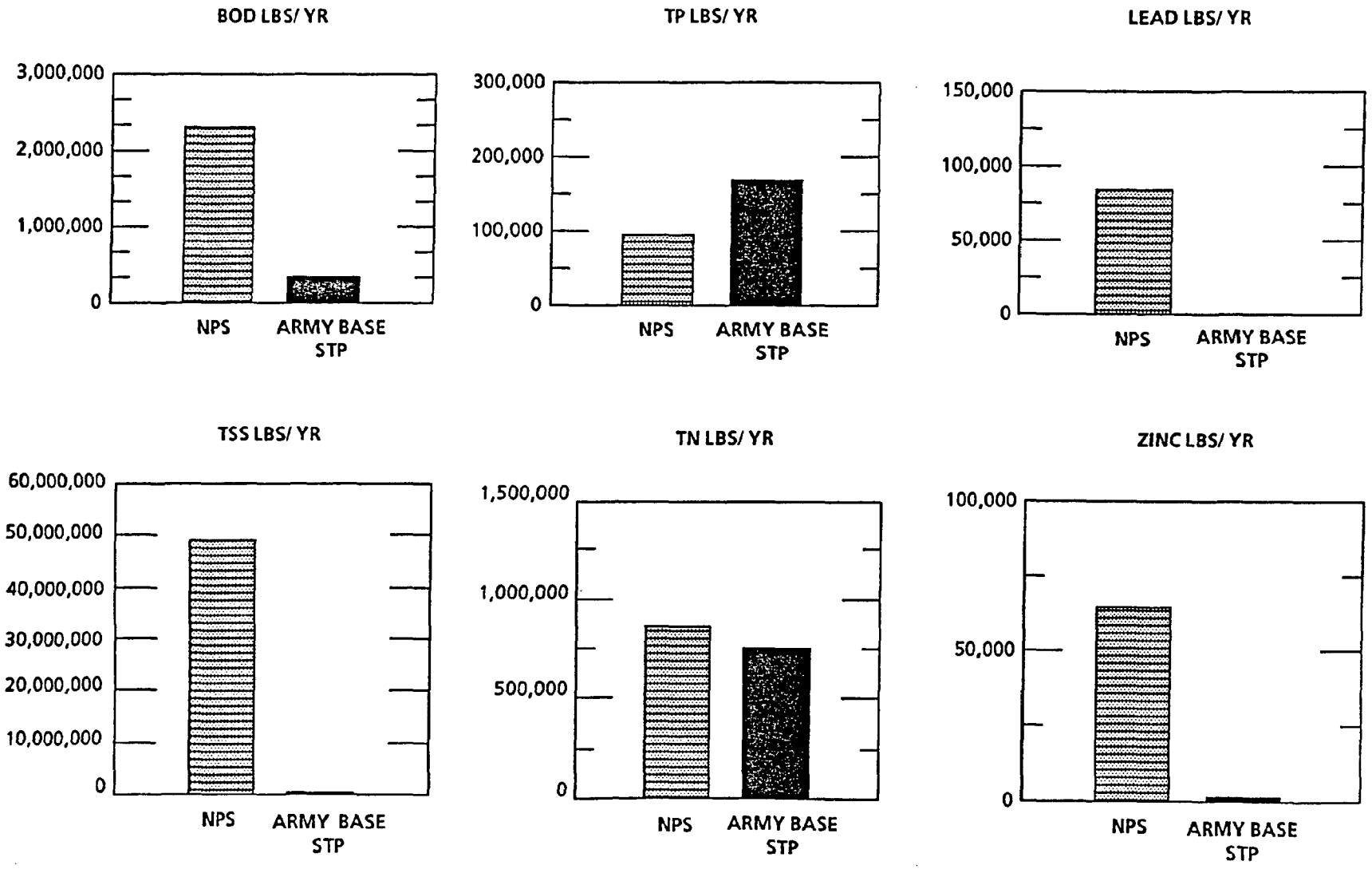
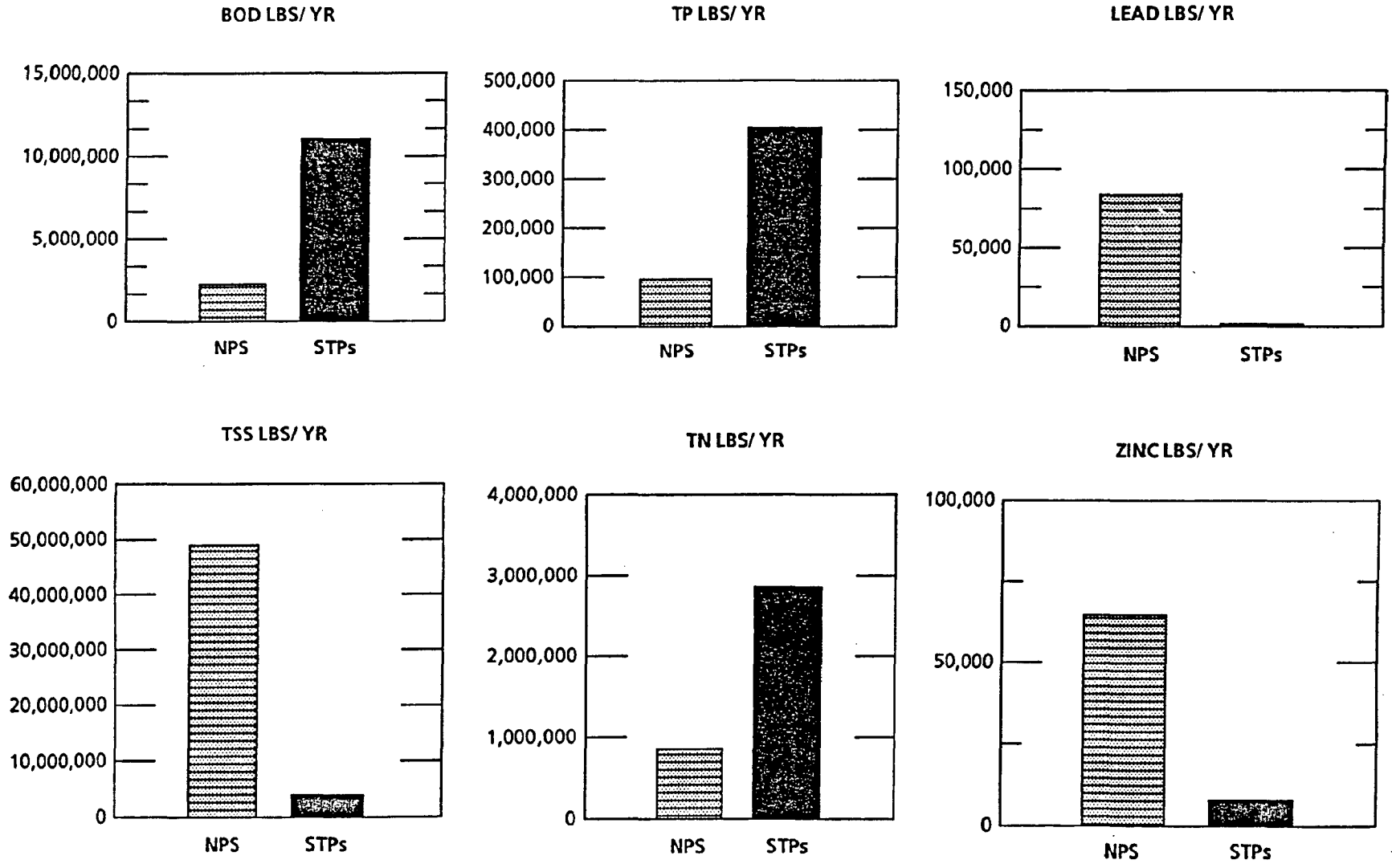


FIGURE 4
ELIZABETH RIVER WATERSHED ANNUAL NONPOINT SOURCE POLLUTANT LOADS COMPARED TO EXISTING ARMY BASE, LAMBERTS POINT, AND PINNERS POINT STPs OPERATING LEVELS



TYPICAL WATERSHEDS

In order to evaluate the nonpoint source problem on a smaller scale, a series of "typical watersheds" have been defined and evaluated. Figure 5 shows the location of the seven typical watersheds. The typical watersheds represent a range of concentrated and mixed land use types. Included are the following types of typical watersheds:

- Urban/downtown residential (the Ghent area of Norfolk).
- Urban/downtown commercial (the central business district area of Norfolk).
- Mixed commercial (the Military Circle/Koger Office Park area of Norfolk).
- Heavy industry (the industrialized area on the eastern shore of the Elizabeth River Southern Branch in Norfolk).
- Low density residential (the upper Lynnhaven area of Virginia Beach).
- Light industry (the Airport Industrial Park area of Virginia Beach).
- Military (the Little Creek Naval Amphibious Base in Virginia Beach).

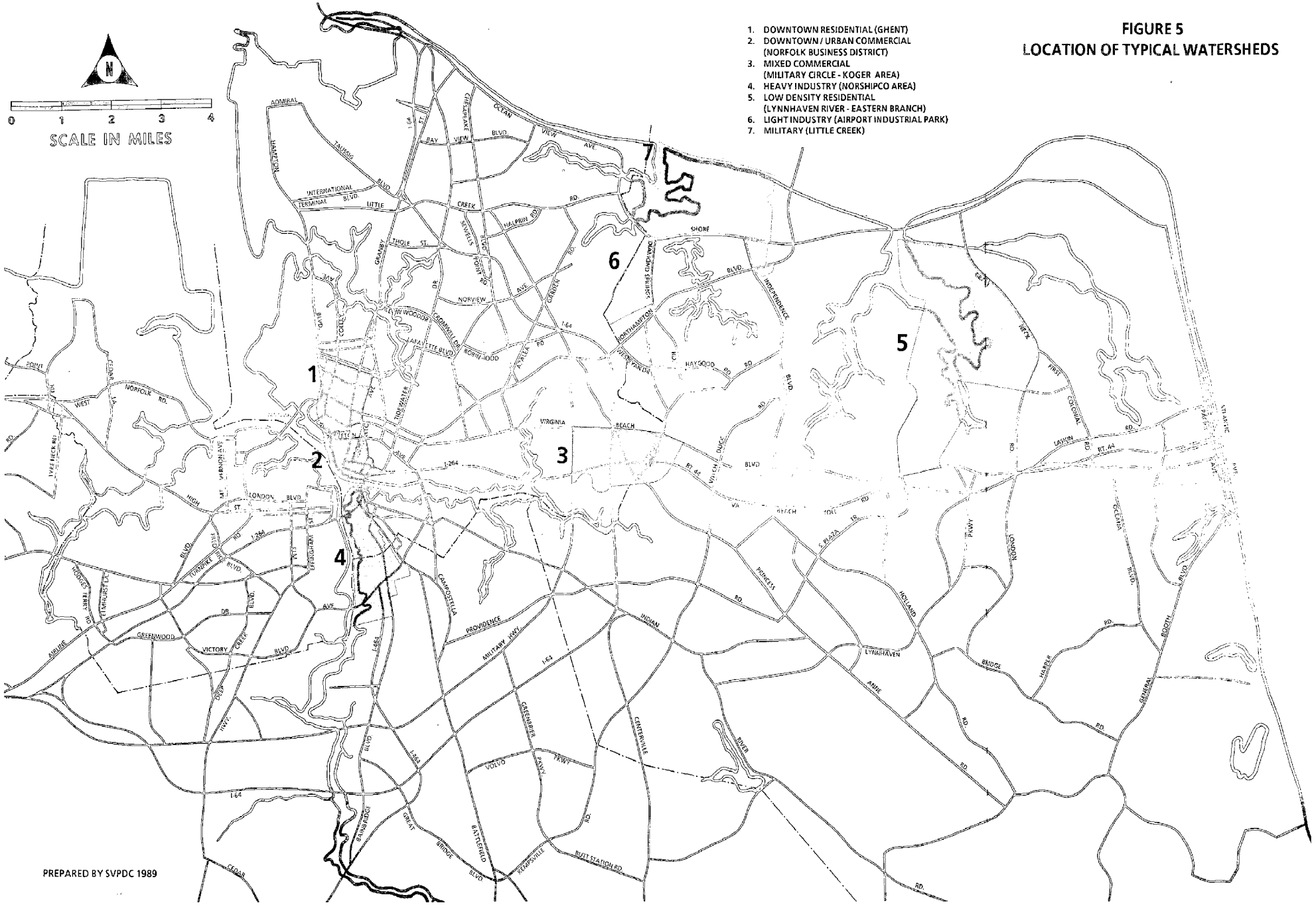
The typical watersheds were selected for analysis and use in preparing stormwater management recommendations for both the Elizabeth River basin and the rest of the SVPDC region. A separate SVPDC report describes the stormwater management plan for the rest of the region. However, the discussion of the three typical watersheds in Virginia Beach are included in this report because since they are also representative of watersheds in the Elizabeth River Basin, and therefore, are useful in making stormwater management recommendations.

By examining these smaller scale watersheds from the perspective of what can be done to minimize nonpoint source pollution, insights may be gained into what can be done on a larger watershed basis to meet pollutant reduction goals. To prepare nonpoint source loading projections, the TDR statistical areas (described elsewhere in this report) within the typical watershed boundaries, were identified. Table 6 documents this allocation. Total acreage for each land use within the typical watershed was calculated and multiplied by the appropriate annual loading factor per acre for each parameter. The typical watershed land use data and loading information is found on Tables 7 - 13.

To facilitate an understanding of the significance of stormwater-borne pollutant loads, Figures 6 through 11 have been prepared for each NPS parameter examined. Those Figures display the annual parameter loading information for each typical watershed and also include the annual loading of that parameter which could be

FIGURE 5
LOCATION OF TYPICAL WATERSHEDS

1. DOWNTOWN RESIDENTIAL (GHENT)
2. DOWNTOWN / URBAN COMMERCIAL (NORFOLK BUSINESS DISTRICT)
3. MIXED COMMERCIAL (MILITARY CIRCLE - KOGER AREA)
4. HEAVY INDUSTRY (NORSHIPCO AREA)
5. LOW DENSITY RESIDENTIAL (LYNNHAVEN RIVER - EASTERN BRANCH)
6. LIGHT INDUSTRY (AIRPORT INDUSTRIAL PARK)
7. MILITARY (LITTLE CREEK)



expected from a one (1) MGD sewage treatment plant. Such a sewage treatment plant would have a service population of approximately ten thousand (10,000) people. While not all of the typical watersheds would have that population, it serves as a useful and approximate comparison of pollutant loads likely to come from both types of sources for similarly sized areas. The Lynnhaven low density residential typical watershed has also been compared to a larger STP that could service its population in the Regional Stormwater Management Strategy for Southeastern Virginia.

Since instream nonpoint source impact sampling and analysis is not a part of this study, the STP comparison also helps draw conclusions regarding instream impacts of typical nonpoint source watershed loadings.

Each typical watershed discussion which follows contains three (3) sections; a general description, a general water quality impact discussion, and a recommended BMP strategy. In the case of the latter, several different information resources were consulted. These include the 1987 WASHCOG publication entitled, Controlling Urban Runoff-A Practical Manual for Planning and Designing Urban BMPs, the 1986 HRWQA Comprehensive Elizabeth River Water Quality Management Plan-Preliminary Management Recommendations, and the companion Report to this effort, the 1989 SVPDC Regional Stormwater Management Strategy for Southeastern Virginia. It is believed that in combination those documents describe the entire range of BMP options which should be considered for the Elizabeth River at this time. Those documents may be consulted for those desiring a comprehensive review of nonpoint source and stormwater management options and pollutant removal efficiencies.

TYPICAL WATERSHED - Urban Downtown Residential (Ghent)

Description

The watershed selected for this analysis includes parts of the Ghent and Ghent Square neighborhoods as well as some surrounding area. The watershed is generally bounded by Hampton Boulevard on the west; the railroad track paralleling 23rd Street on the north; Monticello Avenue on the east; and Virginia Beach Boulevard and Mowbray Arch on the south. The major points of stormwater discharge are to the Hague (Smith Creek), a tributary to the Main Stem of the Elizabeth River.

Land use in the watershed is a mix of commercial, institutional, residential, light industrial and open/undeveloped uses typical of an urban center's periphery area. Residential land uses, including streets, are dominant and range from high density large single family homes to high density multi-story apartment buildings. A portion of the Sentara-Norfolk General Hospital complex is also in this area. As with land use acreages for all of the typical basins in this report, the light industrial category includes streets and highways. Consequently, given the urban nature of

this basin with a large amount of street coverage, a high acreage amount for light industry is reported even though actual industry accounts for a relatively small part of the land use.

Total acreage in the watershed is approximately 606 acres, as shown in Table 7. Nonpoint source loadings, prepared following the methodology described in the introduction to this Section, are also presented in Table 7.

Nonpoint Source Pollution Impacts

Compared to the other typical watersheds, total pollutant loadings for most parameters fall in the middle range. However, on a per acre basis, pollutant loadings for all parameters are very high compared to the other typical basins. This is typical of densely developed areas throughout the nation. The watershed contributes more TSS to the River than would a 1 MGD STP on an annual basis. However, as with all the typical watersheds, nutrient loadings would be substantially less than the 1 MGD STP. As with the other typical watersheds, zinc and lead in stormwater runoff are far greater than the levels expected from the STP. The area to which stormwater is discharged from this watershed is completely bulkheaded and has little or no wetland habitat areas. Nonpoint loading impacts to this area could affect benthic life and conditions, such as species diversity and nutrient stockpiling, and also affect transitting finfish.

Recommended BMP Approach

Very little developable land remains in this watershed. For those small undeveloped areas which do exist, the BMPs most generally recommended for small sites are the various infiltration type practices. Where possible, filter strips and permeable areas should be included in new development and redevelopment. For light traffic areas, porous pavement should be considered. Because of the high water table in this area, the other infiltration practices (infiltration trench and infiltration basin) are not recommended for use in this watershed.

For new development and redevelopment within this typical watershed, erosion and sediment control practices are recommended for all construction activity affecting 2500 square feet or more. Also, the minimum requirements of the CBPA Regulations will have to be implemented, as will the EPA NPDES stormwater permit program.

For the already developed area a resident education effort regarding the proper use and disposal of household products having a potential water quality impact via transport in stormwater should be conducted. This may be accomplished through periodic information flyers in water and sewer billings. Periodic vacuum sweeping of streets should also be conducted.

TYPICAL WATERSHED - Downtown/Urban Commercial (Norfolk Business District)

Description

The watershed selected for this analysis includes the downtown Norfolk waterfront commercial and financial district including The Waterside area. The watershed is generally bounded on the west by the main stem of the Elizabeth River; Brambleton Avenue on the north; St. Paul Boulevard to the Berkley Bridge on the east; and the Eastern Branch of the Elizabeth River on the south. Of course, the major stormwater outfall points discharge to the Main Stem and Southern Branch of the Elizabeth River.

Land use in the watershed is typical of a thriving urban downtown financial and commercial center. Numerous high-rise office buildings dominate the skyline. Marinas, hotel/convention centers and a coliseum are present. Large grade level parking lots are found throughout the watershed and add to the impermeable nature of the land surface.

Total acreage in the watershed is approximately 410 acres, as shown in Table 8. Nonpoint source loadings, prepared following the methodology described in the introduction to this Section, are also presented in that Table.

Nonpoint Source Pollution Impacts

Compared to other developed basins in the Hampton Roads area the total nonpoint loadings coming from this area are relatively small. This is primarily due to the relatively small size of the basin compared to others in this analysis. On the other hand, for most parameters, the loadings per acre from this area are relatively high compared to the other areas, except for TSS (see Figures 6 - 11). The primary reason for the higher per acre loadings is likely due to the very high impermeable cover level of a typical downtown area. Highly impervious areas result in substantially more stormwater runoff than permeable areas. Consequently, higher volumes of pollutants on the land are subject to being transported to receiving waters.

The same Figures referred to in the preceding paragraph allow comparison of runoff parameters from this watershed to a well operated one (1) MGD sewage treatment plant. For two of the parameters (lead and zinc) the nonpoint source annual loadings are greater than they are from the STP.

The area of the Eastern Branch to which this area drains is almost entirely bulkheaded and has very little if any tidal wetlands or other critical habitat areas. Nonpoint loading impacts on benthic conditions and finfish transitting the area could be present.

Recommended BMP Approach

As with the first typical watershed, this area is largely developed with high density urban uses. Infiltration trenches and basins are infeasible due to the high groundwater table. Future controls should be focussed on minimizing construction related sources as new development or redevelopment occurs. Consequently, erosion and sediment control practices should be required on all construction activity affecting greater than 2500 square feet. Further, the final regulations adopted pursuant to the CBPA will have to be complied with, as will the EPA NPDES stormwater permit requirements.

Also, permeable areas, filter strip plantings, and porous pavement should be incorporated in development plans wherever possible. Frequent vacuum street sweeping should be conducted.

Because of limited homeowner landscape maintenance in this area an information and education program regarding disposal of home use materials impacting water quality is likely to have little impact.

TYPICAL WATERSHED - Mixed Commercial (Military Circle-Koger Area)

Description

The watershed selected for this analysis includes the Military Circle Mall and surrounding strip commercial areas and the Koger Executive Center. The watershed is generally bounded on the west by Military Highway; Virginia Beach Boulevard on the north; on the east by a line approximately 1600 feet east of and parallel to Newtown Road; and on the south by Curlew Drive and Southern Boulevard. The major point of stormwater discharge is to an unnamed tributary of the Eastern Branch of the Elizabeth River located directly west of I-64.

Land use in the watershed is dominated by commercial and institutional uses including several hotels and motels, a large office park and medical center. There are a few small pockets of residential uses as well as a large cemetery. The relatively high permeability of the cemetery is offset by the large Interstate Highway interchange also located in the watershed. Even though the watershed has very little light industry, the large number of streets and highways yields a high acreage number for light industry.

Total acreage in the watershed is approximately 1,221 acres, as shown in Table 9. Nonpoint source loadings, prepared following the methodology described in the introduction to this Section, are also presented in Table 9.

Nonpoint Source Pollution Impacts

As with the other typical watersheds, nonpoint source loadings of TSS, lead, and zinc are greater than from the 1 MGD STP. In comparison to the other typical watershed per/acre loadings this watershed is quite high for all parameters.

In terms of impact on critical habitat, runoff from this area will have a much greater impact than will the other Elizabeth River typical watersheds. This is due simply to the fact that the part of the Elizabeth River Eastern Branch to which this area drains has substantial wetland areas. It is likely that other critical habitat features are also present due to the wetland environment. Nonpoint Source impacts on these habitats as described earlier in this Report may be expected.

Recommended BMP Approach

Sufficient developable land exists in this watershed to warrant the use of small dry extended detention ponds or small wet extended detention ponds as new development occurs on the larger tracts of land. Retrofitting of such ponds serving a more regional area may also be feasible in parts of the I-264/44 interchange, through which much of the stormwater from this watershed is directed.

As with all other basins, the requirements of the CBPA will apply to some parts of this watershed, as will the EPA NPDES stormwater permit requirements. Further, erosion and sediment controls on all new development affecting more than 2500 square feet should be required. Also, given the large amount of single family residential development in this watershed, an information and education program as described earlier could have positive results.

TYPICAL WATERSHED - HEAVY INDUSTRY (Norshipco Area)

Description

The watershed selected for this analysis includes the heavily industrialized eastern shore of the lower Southern Branch of the Elizabeth River. The watershed is generally bounded by the Elizabeth River on the west; the Eastern Branch of the Elizabeth River on the north; State Street, Bainbridge Boulevard, B Street and Stewart Avenue on the east; and on the south by Ohio Street, Bainbridge Boulevard and Barnes Road.

Land use in the watershed is principally heavy industry. Two major ship repair facilities are located at the upper end of the watershed (NORSHIPCO and Metro Machine). Petroleum and other liquid storage tank farms front on much of the remaining waterfront in the watershed. Interior areas include some high density single family residential neighborhoods.

Total acreage in the watershed is approximately 1,215 acres, as shown in Table 10. Nonpoint source loadings, prepared following the methodology described in the introduction to this Section, are also presented in that Table.

Nonpoint Source Pollution Impacts

With the exception of lead and zinc, per acre loadings of the other parameters are less than from most of the other typical watersheds (Figures 6 -11). Parameters not studied in this Report may be of more significance to instream water quality and impact on living resources (TBT, PNAHs, and other metals and toxics). However, the shoreline of this area is heavily bulkheaded and has little in the way of tidal wetlands remaining. The most significant impact of runoff to living resources would be to benthic life and finfish transitting the area.

Recommended BMP Approach

This watershed is so intensely developed with heavy industry that "conventional BMPs" will have little applicability. Instead, an environmental impact site audit of each industry in this watershed is recommended. The Chesapeake Bay Preservation Act authorizes localities to use their police powers for water quality protection. Consequently, working with industry management and Virginia Water Control Board staff, City staff or their representatives should conduct extensive site visits and determine what constitute the controllable nonpoint source problems. Together with industry management and the VWCB staff, a control program and implementation schedule should be developed and agreed to. Also, the EPA NPDES stormwater permit requirements will be particularly important here, as will the CBPA criteria related to redevelopment.

TYPICAL WATERSHED - Low Density Residential (Lynnhaven River - Eastern Branch)

Description

Located in Virginia Beach, this 4,211 acre (6.6 square mile) basin includes most of the Eastern Branch of the Lynnhaven River and its watershed. This area is roughly bounded by Shore Drive on the north, Virginia Beach Boulevard on the south, Great Neck Road on the east and Little Neck Road on the west. There is a relatively even distribution of stormwater outfalls along the eastern branch and its tributaries. Many areas in this basin are served by drainage lakes which are tributary to the Lynnhaven River system. These lakes, though originally created for flood control and aesthetic purposes, provide some degree of NPS pollution control.

The dominant physical feature of this basin is the Eastern Branch of the Lynnhaven River which flows south to north through the basin. Extensive areas of marsh and tidal mudflats are associated with this waterway. The developable portions of this watershed are nearly built-out. Land use is primarily low density residential which, for the purposes of this study, is defined as less than seven units

per acre. Low density residential use in this basin is comprised mainly of large-lot subdivisions and waterfront estates. Some medium density residential use is located in the southern portion of the basin and intensive strip commercial use occurs along major thoroughfares (Virginia Beach Boulevard, Great Neck Road and Shore Drive).

Land use and estimated NPS loading data for this basin are shown in Table 11.

Nonpoint Source Pollution Impacts

Compared to other developed basins in the region, estimated average per acre NPS loads to this basin are low to moderate (see Figures 6 -11). This is because of the limited amount of impervious surface and the relatively low intensity of human activity generally associated with low density residential land use. However, NPS water quality problems are a function of both pollutant loadings and the ability of a stream to assimilate pollutants. Because of the Lynnhaven's limited pollutant assimilation capacity, NPS pollution has resulted in significant water quality degradation. The major water quality problems associated with nonpoint sources include excessive siltation, high bacterial levels and nutrient enrichment. Siltation has decreased water depth which has not only impeded navigation but, by reducing tidal exchange, has also decreased the river's ability to assimilate pollutants. Bacterial contamination, as indicated by high fecal coliform levels, has resulted in the closure of nearly all shellfish grounds in the Lynnhaven system. Oxygen supersaturation and elevated chlorophyll "a" values, indicators of nutrient enrichment, have been recorded in the Lynnhaven.[4] One possible explanation for nutrient enrichment is the long term effects of nutrients trapped in the layers of bottom sediment produced by excessive siltation.[5] Over time, these nutrients may be released back into the water column.

As shown in Figures 6 -11, estimated NPS loadings from this basin for BOD, TSS, lead and zinc far exceed expected loadings from a one MGD STP. Total phosphorus and total nitrogen NPS loadings from this basin are also significant in that they are both greater than 50% of the expected STP loadings for the same pollutants.

Recommended NPS Management Strategy

It is expected that extensive areas along and adjacent to the tidal shoreline in this watershed will be designated as Preservation Areas in accordance with the Chesapeake Bay Preservation Act (CBPA). These areas will be subject to regulations which will soon be adopted by the Chesapeake Bay Local Assistance Board and will eventually be incorporated into Virginia Beach's land use controls. These regulations will establish performance criteria for new development, redevelopment and any other activities within the designated Preservation Areas. The proposed performance criteria will provide NPS control benefits by setting requirements for site disturbance, BMP selection, site plan reviews, septic systems, post- development stormwater runoff loads, allowable land uses, nontidal wetlands and buffer zones. Although these criteria are aimed at preventing NPS pollution,

they may actually preclude the development of some BMPs, such as wet detention ponds, that would otherwise be built in Preservation Areas.

Because this basin is nearly fully developed, opportunities for the implementation of NPS control strategies in addition to those that will be required under the CBPA are limited. The following recommendations should be considered to control NPS pollution in this and in other fully developed low density residential basins.

- Where sufficient land is available, encourage use of wet detention basins with extended detention devices as the preferred NPS control option.
- Retrofit existing wet detention basins with extended detention devices.
- Improve inspection and maintenance of public BMP structures and perhaps require owners of private facilities to do the same.
- In areas not served by sanitary sewers, establish onsite sewage treatment management districts to promote the proper operation and maintenance of septic systems.
- Establish educational programs through local civic associations promoting "good housekeeping" practices to reduce NPS pollution. These practices include recycling; proper storage, use and disposal of hazardous materials; proper fertilizer use; proper vehicle maintenance; low maintenance landscaping to prevent erosion; and proper disposal of pet wastes.

TYPICAL WATERSHED - Light Industrial (Airport Industrial Park)

Description

This 545 acre basin contains the Virginia Beach Airport Industrial Park. Basin boundaries are Shore Drive on the north, the Norfolk and Western rail line on the south, Diamond Springs Road on the east and Norfolk International Airport on the west. This basin drains from south to north into an unnamed creek which flows into Lake Whitehurst and Little Creek Reservoir, two Norfolk water supply lakes. There are several detention ponds within this basin which were probably created as borrow pits, but now provide some flooding and NPS pollutant control.

The Airport Industrial Park, which covers most of this basin, is nearly built out with a mixture of light industrial and office uses. Some vacant land and a small amount of low density residential use exist in the southern portion of the basin.

Land use and estimated NPS loading data for this basin are shown in Table 12.

Nonpoint Source Pollutant Impacts

With the exception of TSS and fecal coliform, estimated average per acre NPS pollutant loads for this basin are high (see Figures 6 - 11). This can be explained by increased runoff rates resulting from the high degree of imperviousness associated with this mix of land uses. The types of activities associated with these land uses may also be a factor. The elevated loadings for lead and zinc are most likely due to the heavy motor vehicle traffic generated by commercial and industrial uses.

Despite the small size of this basin, estimated loadings for lead and zinc greatly exceed those that can be expected from a one MGD STP (see Figures 6 -11). For the other parameters, absolute estimated loadings are small in comparison to the hypothetical STP loadings, but per acre averages indicate that a basin of this type has a high potential for generating NPS pollution.

Recommended NPS Management Strategies

The following recommendations should be considered in highly developed drainage basins with predominantly light industrial land use.

- Give preference to the following structural controls in any new development: wet detention basins with extended detention devices, the use of porous pavement for parking lots and other low traffic volume areas, and rooftop detention and disposal facilities.

- Where feasible, incorporate in-line storage facilities, flow regulators and treatment facilities (including oil and grease separators) into new or existing stormwater conveyance systems. Encourage the owners of privately owned and maintained drainage facilities to do the same.

- Increase the frequency of street and parking lot sweeping. If possible, use vacuum sweepers.

- Retrofit existing detention basins with extended detention devices.

- Implement an educational program encouraging managers of industrial and commercial establishments to implement policies which might achieve a variety of objectives including NPS pollutant control. This program might address proper outside material storage, recycling of solid and hazardous wastes, compliance with hazardous material and underground storage tank regulations, low maintenance landscaping, and car and van pooling.

- Improve inspection and maintenance of public BMP structures and perhaps require owners of private facilities to do the same.

- Establish low-maintenance vegetative buffers along drainage ditches and the plant wetland grasses in detention basins.

TYPICAL WATERSHED - Military (Little Creek)

Nearly all of this 2,386 acre (3.7 square mile) basin is occupied by the Little Creek Naval Amphibious Base. This basin comprises about 15% of the entire Little Creek watershed. Its boundaries are the Chesapeake Bay on the north, Shore Drive on the south and west, and Lake Bradford and Chubb Lake on the east. Drainage in this basin is to Little Creek to the west, and to a series of seven small lakes, including Lake Bradford and Chubb Lake, to the east and the Chesapeake Bay to the north.

Overall land use on the Naval Amphibious Base is of relatively low density. Nearly 50% of the land area is classified as either open or undeveloped and includes dunes, beaches, wooded areas, a golf course and playing fields. The developed areas of the base contain a mix of commercial/institutional, industrial and residential facilities. The industrial uses primarily include the docking, maintenance, repair and training facilities associated with the base's fleet of amphibious assault craft. A private shipyard, a small railyard and the HRSD Chesapeake- Elizabeth Sewage Treatment Plant, all located along Shore Drive, are the only non-military uses within this basin.

Land use and estimated NPS loading data for this basin are shown in Table 13.

Nonpoint Source Pollutant Impacts

Given the large amount of open and undeveloped land in the basin as a whole, estimated per acre average loadings for each of NPS pollutant parameters are low to moderate (see Figures 6 - 11). Despite the low basinwide loadings, Little Creek Harbor suffers from severe water quality degradation. High nutrient levels, depleted DO and high fecal coliform counts have been recorded.[6] Due to high fecal coliform counts, shellfish areas within Little Creek have been condemned since 1935. These water quality problems can be partially attributed to the Creek's limited ability to assimilate pollutants. They may also be due to significant NPS loadings generated by industrial uses in the vicinity of docking facilities, and, perhaps more importantly, to the operation and maintenance of military, commercial and recreational vessels using these facilities. NPS loading rates were not developed for marine vessels and marinas due to their high degree of variability. Thus, these sources are not accounted for in the basinwide loading estimates. No information is available on NPS water quality impacts in the lakes draining the eastern portion of the base.

Even with the large amount of open and undeveloped land and the small degree of imperviousness in this basin, estimated TSS, lead and zinc loadings are still many times greater than those that can be expected from a one MGD STP (see

Figures 6 -11). Estimated NPS loadings for BOD, total phosphorus and total nitrogen are significantly lower than those from the hypothetical STP.

Recommended NPS Control Strategies

The most effective BMPs for this basin would be those directed towards the operation and maintenance of military, commercial and recreational vessels using Little Creek Harbor. A description and analysis of such BMPs is beyond the scope of this study. The reader is referred to the Coastal Marinas Assessment Handbook, developed by EPA Region IV, for further information.

To address NPS problems occurring on this or other military bases, consideration should be given to developing a watershed management plan. Because the entire watershed is under the control of one landowner, there is more of an opportunity for identifying and devoting sufficient attention to resolving basin-specific NPS problems. The following strategies should be considered for inclusion in a watershed management plan for a military base.

- Enforce good housekeeping practices such as recycling of solid and hazardous wastes; proper storage, use and disposal of hazardous materials; proper fertilizer use; proper vehicle maintenance; low maintenance landscaping to prevent erosion; proper outside material storage; and compliance with hazardous materials and wastes, underground storage tank and stormwater permitting regulations.

- Give preference to the following structural controls in any new development: wet detention basins with extended detention devices, the use of porous pavement for parking lots and other low traffic volume areas, and rooftop detention and disposal facilities.

- Improve inspection and maintenance of BMP structures.

- Where feasible in industrial areas, incorporate in-line storage facilities, flow regulators and treatment facilities (including oil and grease separators) into new or existing stormwater conveyance systems.

- Increase the frequency of street and parking lot sweeping in areas of the base with heavy motor vehicle traffic. If possible, use vacuum sweepers.

- Establish low-maintenance vegetative buffers along drainage ditches and around any water bodies receiving runoff.

TABLE 6

TYPICAL WATERSHEDS

STATISTICAL AREA COMPOSITION

Heavy Industry (Norshipco, etc.)	Downtown Commercial (Downtown Norfolk)	Military (Little Creek)	Light Industry (Airport Industrial Park)	Mixed Commercial (Military Circle - Koger - Resid.)	Downtown Residential (Ghent)		Lynnhaven Low Density Residential
71010	51030	57030	57710	55430	51211 (50%)	51270	61110 (60%)
71030	51040	57020		55410	51220	51110	61220
71040	50170	57110		55420	51230	51111	61210 (85%)
71020	50180	57120		55510 (50%)	50210	51120	62610
71050	50190	59330		55520 (15%)	50220	51121	62710
71620	51060			58610	51210	51130	62010
71510	51050			58620	51260	51131	
71610	50010			58630	51240	51141	
71630	50020			58640	51241	51150	
71580	50030			58650	50260	51170	
71530	50040			58660	50270	51181	
71570	50050			58730 (50%)	50250	51180 (30%)	
71640	50450			58740 (33%)	50120	51171	
71560 (35%)	50060				50130	51172	
71680 (60%)	50070				50110		
71670 (50%)	51071				51250		
	51070				51251		

TABLE 7
TYPICAL WATERSHED
ANNUAL NONPOINT SOURCE LOADINGS
1985 LAND USE
DOWNTOWN RESIDENTIAL - GHENT

	Commercial and Institutional	Light Industry/ Streets	Heavy Industry	Low Density Residential	High Density Residential	Agriculture	Open and Undeveloped	Water	Total	Loadings Per Acre
Land Use										
Total Acreage	158.6	185.0	--	--	160.8	--	91.7	10.7	606.8	
Percent of Basin	26.0	30.0	--	--	27.0	--	15.0	2.0		
Parameter Loadings										
BOD	5,931.6	4,033.0	--	--	5,837.0	--	155.9	--	15,957.5	26.3
TSS	46,628.4	30,895.0	--	--	41,004.0	--	1,100.4	--	119,627.8	197.0
Fecal Coliform	24,408.5	9,897.5	--	--	58,113.1	--	91.7	--	92,510.8	--
Total Phosphorus	242.6	159.1	--	--	215.5	--	4.6	7.5	629.3	1.0
Total Nitrogen	2,394.9	1,591	--	--	2,122.6	--	55.0	17.1	6,180.6	10.2
Lead	344.2	327.5	--	--	107.7	--	1.8	19.3	800.5	1.3
Zinc	242.6	259.0	--	--	53.0	--	1.8	19.3	575.7	1.0

Note: All loadings expressed in pounds per year, except Fecal Coliform which is expressed as 10^9 cells.

Source: SVPDC and HRWQA, 1989.

TABLE 8
TYPICAL WATERSHED
ANNUAL NONPOINT SOURCE LOADINGS
1985 LAND USE
DOWNTOWN COMMERCIAL - NORFOLK CBD

	Commercial and Institutional	Light Industry/ Streets	Heavy Industry	Low Density Residential	High Density Residential	Agriculture	Open and Undeveloped	Water	Total	Loadings Per Acre
Land Use										
Total Acreage	115.2	81.7	52.9	11.3	7.1	--	74.6	67.8	410.6	
Percent of Basin	28.0	20.0	12.0	3.0	2.0	--	18.0	17.0		
Parameter Loadings										
BOD	4,308.5	1,781.1	1,153.2	211.3	257.7	--	126.8	--	7,838.6	19.1
TSS	33,868.8	13,643.9	8,834.3	1,638.5	1,810.5	--	895.2	--	31,130.9	76.0
Fecal Coliform	17,729.3	4,370.9	2,830.2	984.2	2,565.9	--	74.6	--	28,555.1	--
Total Phosphorus	176.3	70.3	45.5	8.5	9.5	--	3.7	47.5	361.3	0.9
Total Nitrogen	1,739.5	702.6	454.9	83.6	93.7	--	44.7	108.5	3,227.5	7.9
Lead	250.0	144.6	93.6	2.7	4.7	--	1.5	1.4	498.5	1.2
Zinc	176.3	114.4	74.0	2.0	2.3	--	1.5	1.4	371.9	0.9

Note: All loadings expressed in pounds per year, except Fecal Coliform which is expressed as 10^9 cells.

Source: SVPDC and HRWQA, 1989.

TABLE 9
TYPICAL WATERSHED
ANNUAL NONPOINT SOURCE LOADINGS
1985 LAND USE
MIXED COMMERCIAL - MILITARY CIRCLE/KOGER

	Commercial and Institutional	Light Industry/ Streets	Heavy Industry	Low Density Residential	High Density Residential	Agriculture	Open and Undeveloped	Water	Total	Loadings Per Acre
Land Use										
Total Acreage	387.3	263.9	--	146.3	40.9	0.6	301.4	80.9	1,221.3	
Percent of Basin	31.7	21.6	--	12.0	3.3	0.1	24.7	6.6		
Parameter Loadings										
BOD	14,485.0	5,753.0	--	2,735.8	1,484.7	27.0	512.4	--	24,997.9	20.5
TSS	113,866.2	44,071.3	--	21,213.5	10,429.5	2,160.0	3.6	--	195,357.0	155.0
Fecal Coliform	59,605.5	14,118.6	--	12,742.7	14,781.3	--	301.4	--	101,549.5	--
Total Phosphorus	592.6	226.9	--	109.7	54.8	0.6	15.0	56.6	1,056.2	0.9
Total Nitrogen	5,848.2	2,269.5	--	1,082.6	539.9	5.5	180.8	129.4	10,055.8	8.2
Lead	840.0	467.1	--	35.1	27.4	--	6.0	1.6	1,377.2	1.1
Zinc	592.6	369.5	--	26.3	13.5	0.1	6.0	1.6	1,009.6	0.8

Note: All loadings expressed in pounds per year, except Fecal Coliform which is expressed as 10^9 cells.

Source: SVPDC and HRWQA, 1989.

TABLE 10
TYPICAL WATERSHED
ANNUAL NONPOINT SOURCE LOADINGS
1985 LAND USE
HEAVY INDUSTRY - NORSHIPCO AREA

	Commercial and Institutional	Light Industry/ Streets	Heavy Industry	Low Density Residential	High Density Residential	Agriculture	Open and Undeveloped	Water	Total	Loadings Per Acre
Land Use										
Total Acreage	135.7	48.7	405.6	10.6	110.3	--	269.5	235.3	1,215.7	
Percent of Basin	12.0	4.0	33.0	1.0	9.0	--	22.0	19.0		
Parameter Loadings										
BOD	5,075.2	1,061.7	8,842.1	198.2	4,003.9	--	458.2	--	19,639.2	16.2
TSS	39,895.8	8,132.9	67,735.2	1,537.0	28,126.5	--	3,234.0	--	148,661.4	122.0
Fecal Coliform	20,884.2	2,605.4	21,699.6	923.3	39,862.4	--	269.5	--	86,244.4	--
Total Phosphorus	207.6	41.9	348.8	7.9	147.8	--	13.5	164.7	932.2	0.8
Total Nitrogen	2,049.0	418.8	3,488.2	78.4	1,456.0	--	161.7	376.5	8,028.6	6.6
Lead	294.5	86.2	717.9	2.5	73.9	--	5.4	4.7	1,185.1	1.0
Zinc	207.6	68.2	568.0	1.9	36.4	--	5.4	4.7	892.2	0.9

Note: All loadings expressed in pounds per year, except Fecal Coliform which is expressed as 10^9 cells.

Source: SVPDC and HRWQA, 1989.

TABLE 11
TYPICAL WATERSHED
ANNUAL NONPOINT SOURCE LOADINGS
1985 LAND USE
LOW DENSITY RESIDENTIAL - LYNNHAVEN

	Commercial and Institutional	Light Industry/ Streets	Heavy Industry	Low Density Residential	High Density Residential	Agriculture	Open and Undeveloped	Water	Total	Loadings Per Acre
Land Use										
Total Acreage	156.2	316.8	--	1,462.4	--	136.9	818.4	1,320.0	4,210.7	
Percent of Basin	3.7	7.5	--	34.7	--	3.3	19.4	31.3		
Parameter Loadings										
BOD	5,841.9	6,906.2	--	27,346.9	--	6,160.5	1,391.3	--	47,646.8	11.3
TSS	45,922.8	52,905.6	--	212,048.0	--	492,840.0	9,820.8	--	813,537.0	193.2
Fecal Coliform	24,038.2	16,918.8	--	127,375.0	--	--	818.4	--	169,150.5	--
Total Phosphorus	239.0	272.0	--	1,096.8	--	142.4	40.9	924.0	2,715.1	0.6
Total Nitrogen	2,358.6	2,719.7	--	10,821.8	--	1,245.8	491.0	2,112.0	19,748.9	4.7
Lead	339.0	559.7	--	351.0	--	5.5	16.4	26.4	1,297.9	0.3
Zinc	239.0	442.7	--	263.2	--	30.1	16.4	26.4	1,017.9	0.2

Note: All loadings expressed in pounds per year, except Fecal Coliform which is expressed as 10^9 cells.

Source: SVPDC and HRWQA, 1989.

TABLE 12
TYPICAL WATERSHED
ANNUAL NONPOINT SOURCE LOADINGS
1985 LAND USE
LIGHT INDUSTRY - AIRPORT INDUSTRIAL PARK

	Commercial and Institutional	Light Industry/ Streets	Heavy Industry	Low Density Residential	High Density Residential	Agriculture	Open and Undeveloped	Water	Total	Loadings Per Acre
Land Use										
Total Acreage	130.7	149.8	--	39.7	--	4.6	109.6	19.7	454.1	
Percent of Basin	29.0	33.0	--	9.0	--	1.0	24.0	4.0		
Parameter Loadings										
BOD	4,888.2	3,265.6	--	742.4	--	207.0	186.3	--	9,289.5	20.5
TSS	38,425.8	25,016.6	--	5,756.5	--	16,560.0	1,315.2	--	87,074.0	192.0
Fecal Coliform	20,114.7	8,014.3	--	3,457.9	--	--	109.6	--	31,696.5	--
Total Phosphorus	200.0	128.8	--	29.8	--	4.8	5.5	13.8	382.7	0.8
Total Nitrogen	1,973.6	1,288.3	--	293.8	--	41.9	65.8	31.5	3,694.9	8.1
Lead	283.6	265.1	--	9.5	--	0.2	2.2	0.4	561.0	1.2
Zinc	200.0	209.7	--	7.1	--	1.0	2.2	0.4	420.4	0.9

Note: All loadings expressed in pounds per year, except Fecal Coliform which is expressed as 10^9 cells.

Source: SVPDC and HRWQA, 1989.

TABLE 13
TYPICAL WATERSHED
ANNUAL NONPOINT SOURCE LOADINGS
1985 LAND USE
MILITARY - LITTLE CREEK

	Commercial and Institutional	Light Industry/ Streets	Heavy Industry	Low Density Residential	High Density Residential	Agriculture	Open and Undeveloped	Water	Total	Loadings Per Acre
Land Use										
Total Acreage	241.8	358.8	--	206.9	--	--	1,109.9	469.0	2,386.4	
Percent of Basin	10.0	15.0	--	8.0	--	--	47.0	20.0		
Parameter Loadings										
BOD	9,043.3	7,821.8	--	3,869.0	--	--	1,886.8	--	22,620.9	9.5
TSS	71,089.2	59,919.6	--	30,000.5	--	--	13,318.8	--	174.328.1	73.0
Fecal Coliform	37,213.0	19,195.8	--	18,021.0	--	--	1,109.9	--	75,539.7	--
Total Phosphorus	369.9	308.6	--	155.2	--	--	55.5	328.3	1,217.5	0.5
Total Nitrogen	3,651.2	3,085.6	--	1,531.1	--	--	665.9	750.4	9,684.2	4.1
Lead	524.7	635.1	--	49.7	--	--	22.2	9.4	1,241.1	0.5
Zinc	369.9	502.3	--	37.2	--	--	22.2	9.4	941.0	0.4

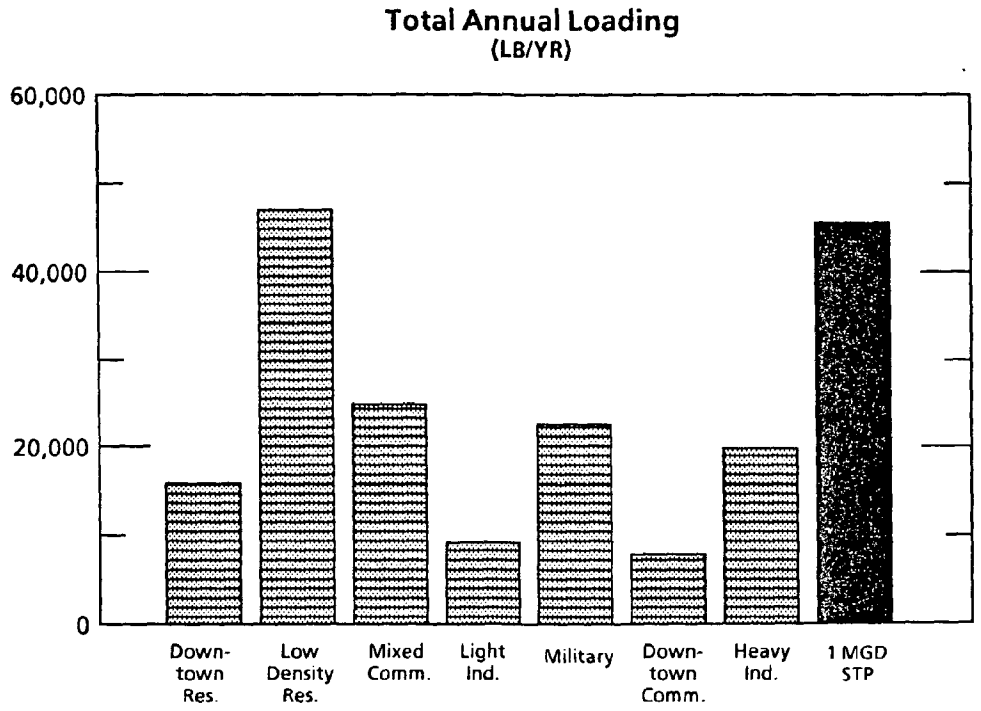
Note: All loadings expressed in pounds per year, except Fecal Coliform which is expressed as 10^9 cells.

Source: SVPDC and HRWQA, 1989.

FIGURE 6

TYPICAL WATERSHED ANNUAL LOADINGS COMPARED TO A ONE (1) MGD SEWAGE TREATMENT PLANT

BIOLOGICAL OXYGEN DEMAND



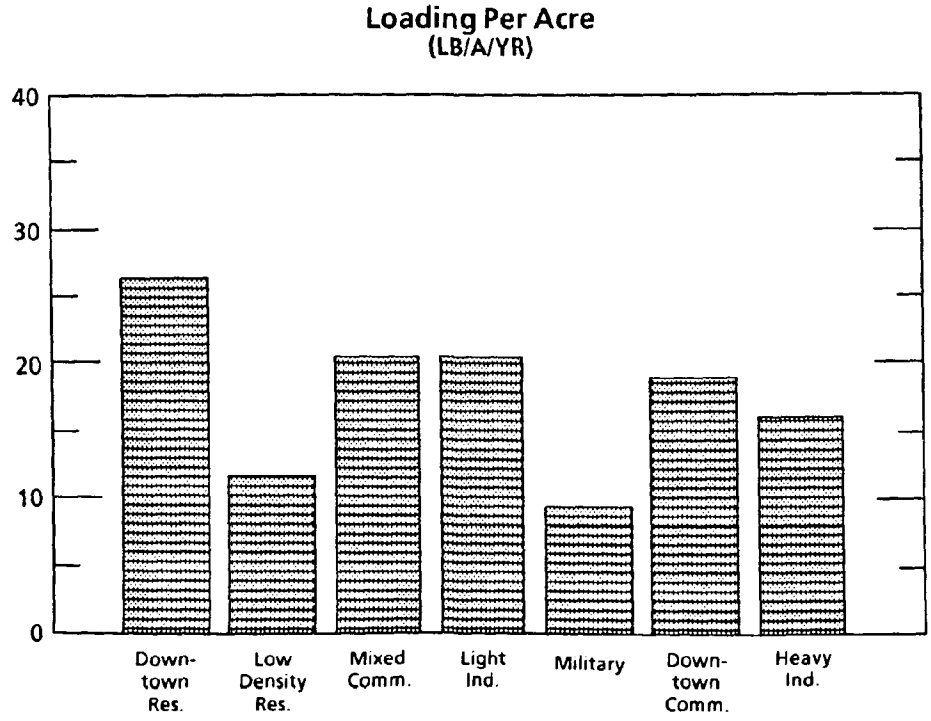
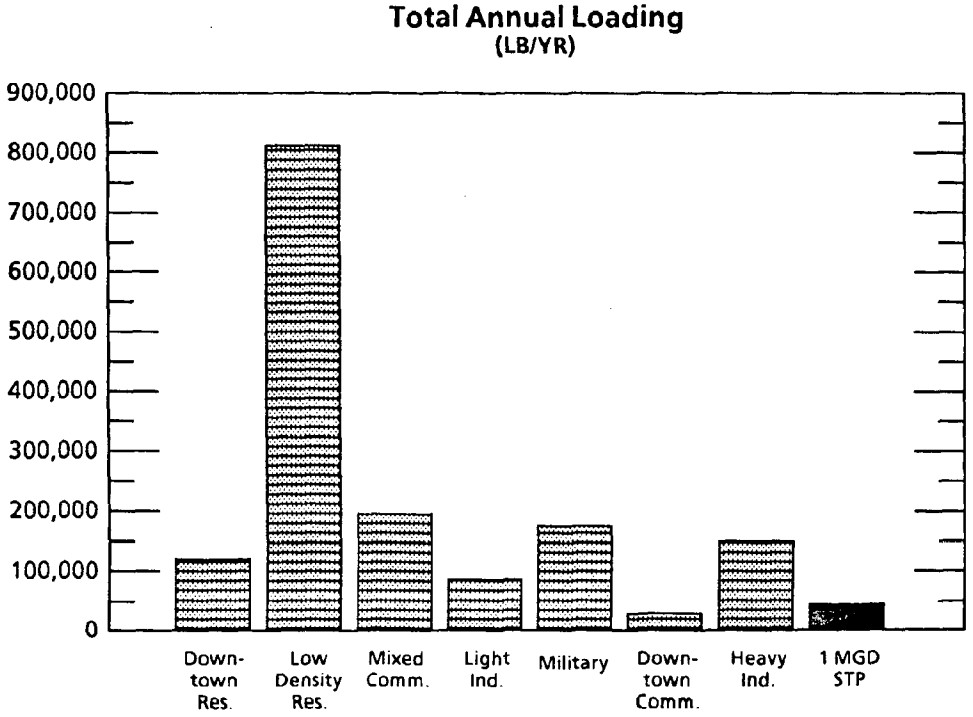


FIGURE 7

TYPICAL WATERSHED ANNUAL LOADINGS COMPARED TO A ONE (1) MGD SEWAGE TREATMENT PLANT

TOTAL SUSPENDED SOLIDS



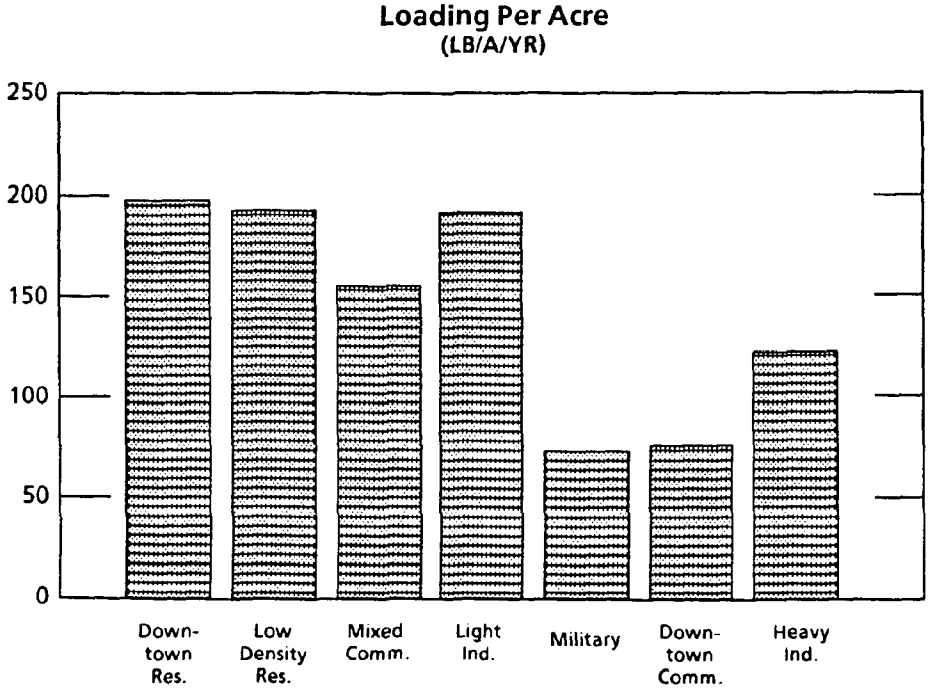
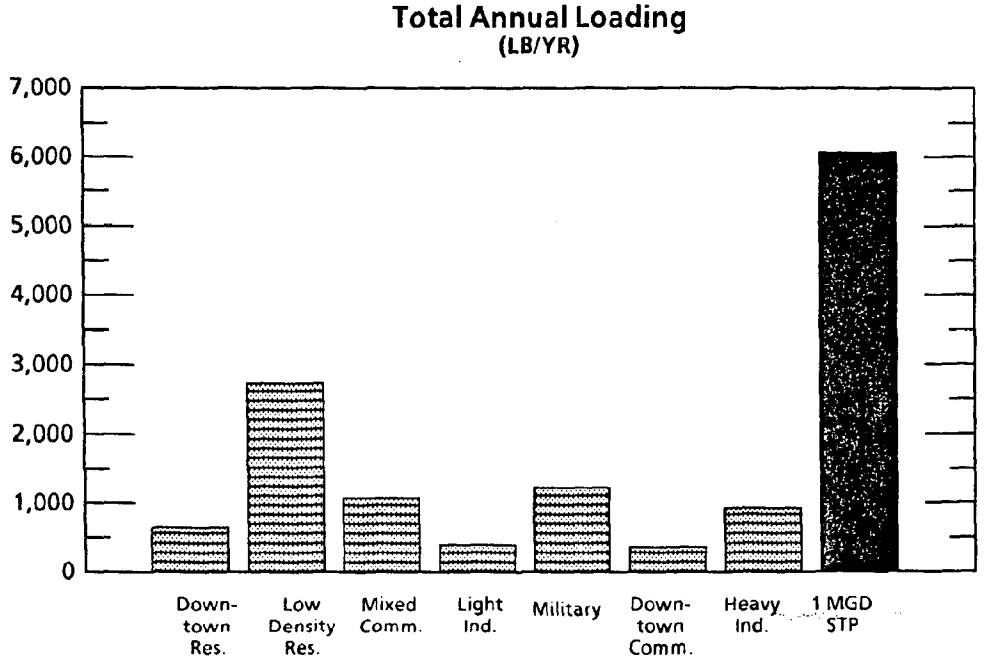


FIGURE 8

TYPICAL WATERSHED ANNUAL LOADINGS COMPARED TO A ONE (1) MGD SEWAGE TREATMENT PLANT

TOTAL PHOSPHORUS



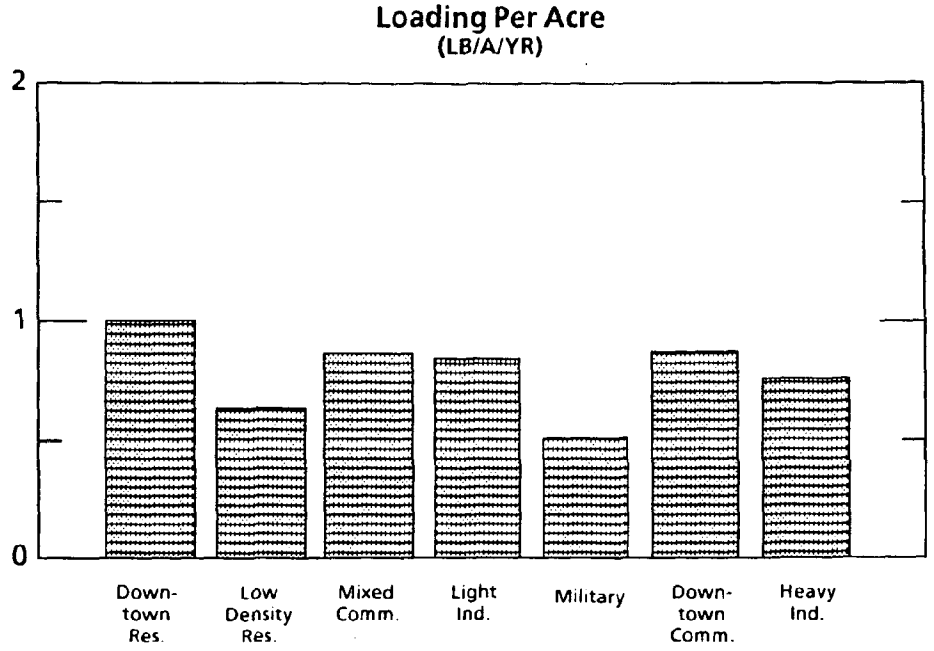
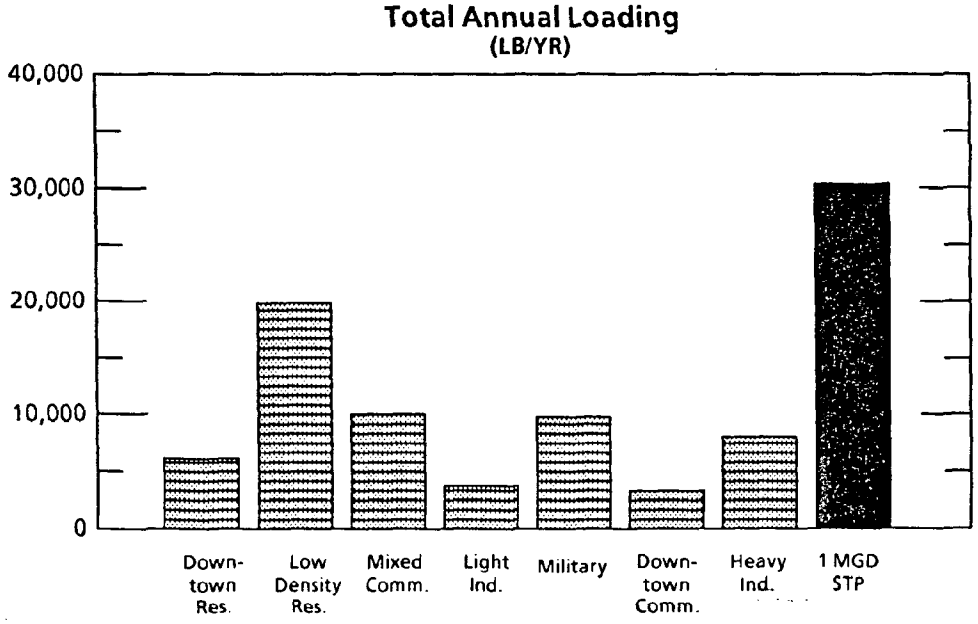


FIGURE 9

TYPICAL WATERSHED ANNUAL LOADINGS COMPARED TO A ONE (1) MGD SEWAGE TREATMENT PLANT

TOTAL NITROGEN



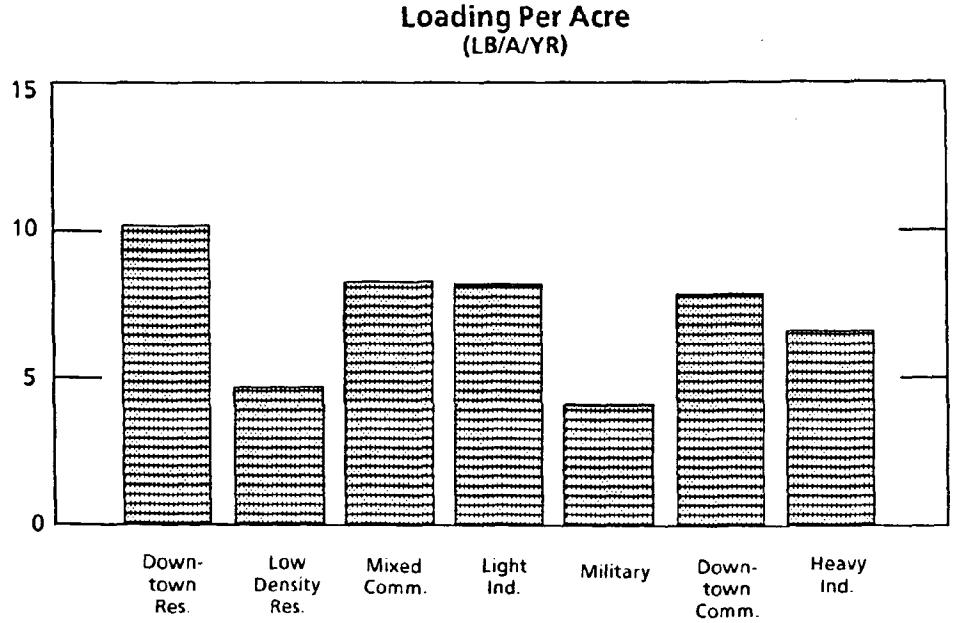
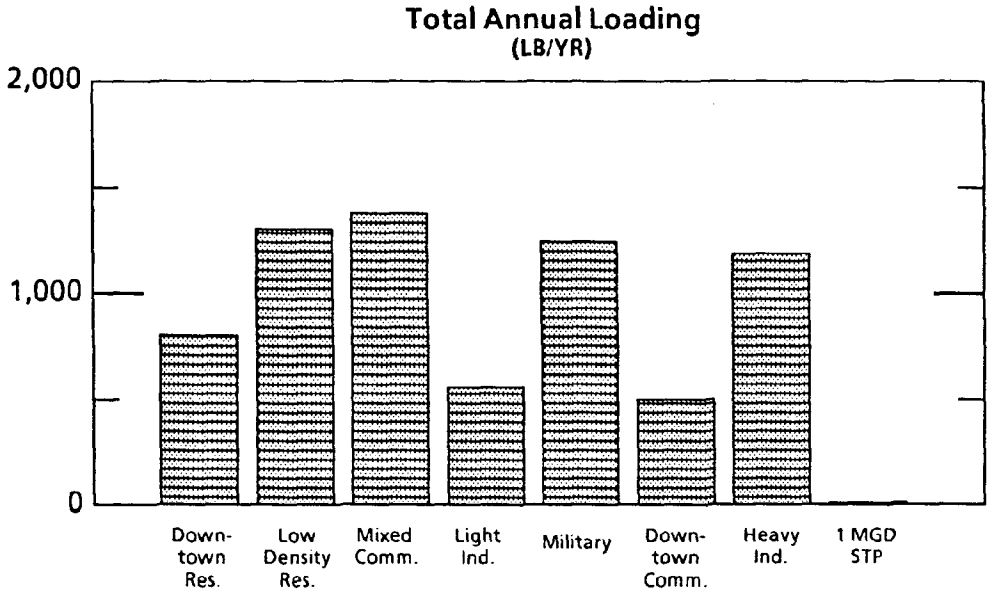


FIGURE 10

TYPICAL WATERSHED ANNUAL LOADINGS COMPARED TO A ONE (1) MGD SEWAGE TREATMENT PLANT

LEAD



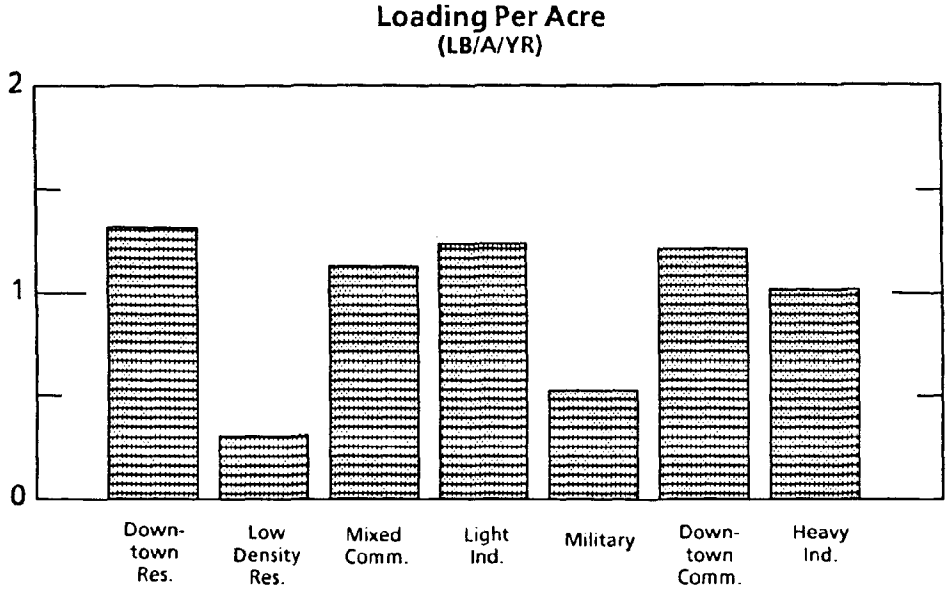
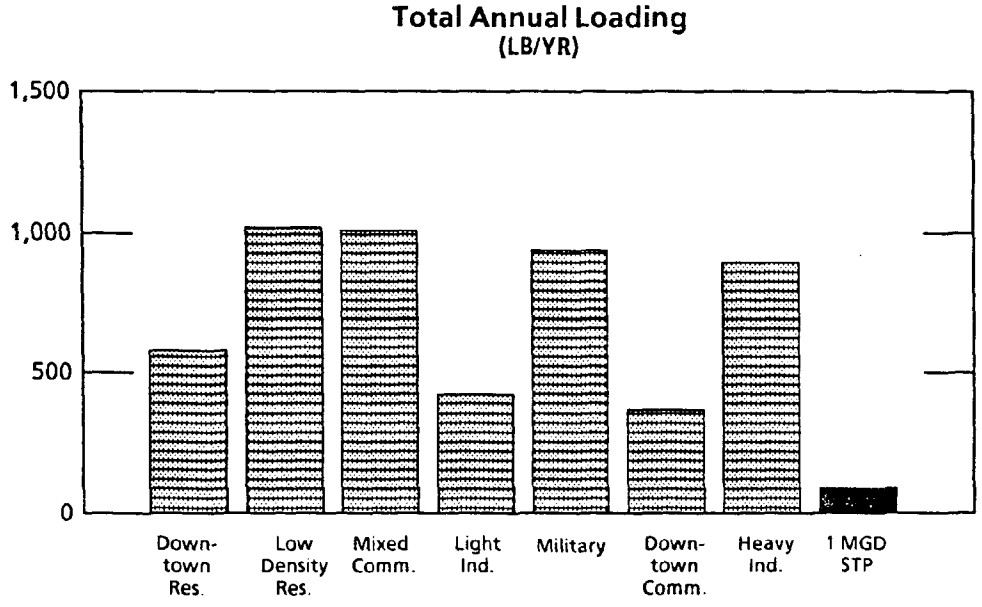
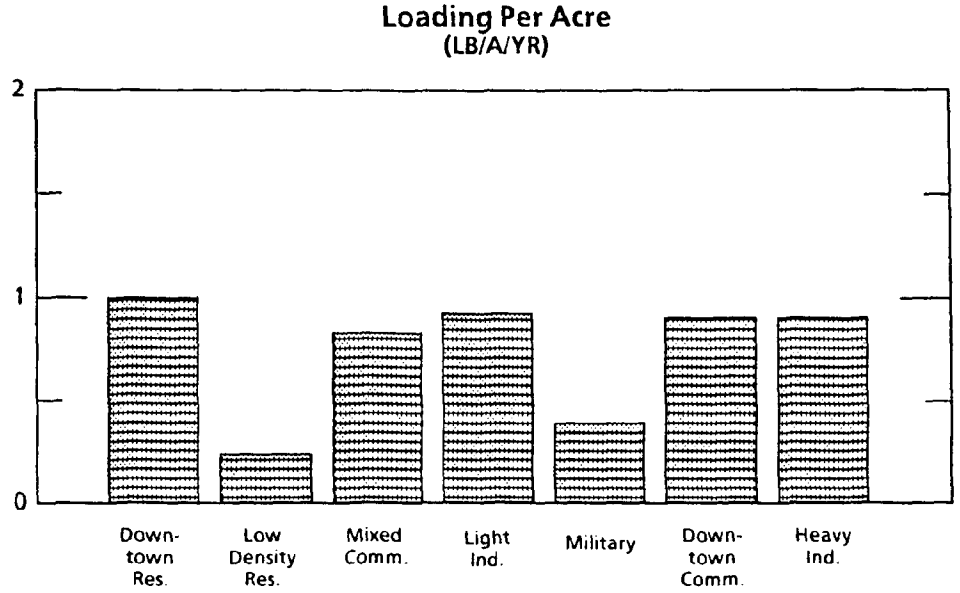


FIGURE 11
TYPICAL WATERSHED ANNUAL LOADINGS COMPARED TO A ONE (1) MGD SEWAGE TREATMENT PLANT
ZINC





NOTES TO FIGURES 6-11

Hypothetical one (1) MGD municipal sewage treatment plant - service population approximately 10,000.

Operation based on advanced secondary treatment with biological nutrient removal:

EFFLUENT CHARACTERIZATION

BOD (1)	15 mg/1
TSS (1)	15 mg/1
TN (1)	10 mg/1
TP (1)	2 mg/1
LEAD (2)	0.0025 mg/1
ZINC (2)	0.03 mg/1

(1) Reasonably expected operating levels provided by HRSD Director of Water Quality.

(2) Based on average for all nine (9) HRSD STPs as reported in 1987 Wastewater Characterization Report.

ELIZABETH RIVER WATERSHED STORMWATER MANAGEMENT STRATEGY

Over the last decade-and-a-half the Hampton Roads Water Quality Agency and the Southeastern Virginia Planning District Commission have made extensive recommendations for the control of nonpoint source pollution in stormwater runoff within the Greater Hampton Roads area. Many of those recommendations were based on authorities existing at the time such as the Virginia Erosion and Sediment Control Law, Wetlands legislation and others. Most of those recommendations remain valid and are included in a latter section of this strategy.

In addition to those approaches to stormwater quality management, more recently the State and Federal governments have enacted additional legislation, adopted other programs, and established goals related to this issue. Included are Section 319 of the Clean Water Act, the EPA National Pollution Discharge Elimination System (NPDES) Permit Requirements for stormwater discharges, the Virginia Chesapeake Bay Preservation Act, the 1989 Virginia General Assembly legislation authorizing local government to establish stormwater management programs (SB 722/HB 1848), the forty (40%) percent nutrient reduction goal of the Chesapeake Bay Agreement, and others.

The EPA NPDES permit requirements for stormwater discharges, the Virginia CBPA land use management directives, and the Virginia enabling legislation allowing local stormwater management programs are considered particularly useful in preparing a recommended stormwater management strategy for the Elizabeth River and are discussed further below.

NPDES PERMITS FOR STORMWATER DISCHARGES

The 1987 Water Quality Act mandates that municipalities obtain NPDES permits for their stormwater discharges. Large municipal separate systems (those municipalities having a population of 250,000 or more) must be in compliance with the permits by 1992. Medium systems (those municipalities having a population of 100,000-249,999) must be in compliance by 1994. Those deadlines may be pushed back depending on the final date of issuance of the controlling regulations. In addition to the permit application process itself, localities are required to prepare a stormwater management program for four categories of discharges:

- Runoff from commercial and residential areas.
- Runoff from industrial areas.
- Runoff from construction sites.
- Non-stormwater discharges.

A more detailed examination of the proposed EPA Regulations for implementing this program has been prepared as part of this effort and is found as Appendix J.

VIRGINIA ENABLING LEGISLATION ALLOWING LOCAL STORMWATER MANAGEMENT

Action by the 1989 Virginia General Assembly (SB 722/HB 1848) authorizes local governments to establish their own stormwater management programs. If a locality decides to have such a program, it is to: 1) provide for long term responsibility for maintenance of stormwater management control devices and techniques to control the quality and quantity of runoff; and, 2) provide for the integration of the stormwater program with the erosion and sediment control law and other related federal and state programs having similar objectives. Any locally developed program is to meet minimum criteria to be established by the Department of Conservation and Historic Resources. Those criteria are to be minimum standards for post-development runoff volume and pollutant reduction compared to the pre-development condition. A key provision of this legislation, as originally proposed, would have allowed localities to develop a stormwater management utility district approach to funding improvements and maintenance operations. That authorization was deleted from the adopted legislation.

CHESAPEAKE BAY PERSERVATION ACT REQUIREMENTS

The Chesapeake Bay Preservation Act requires the designation of a Chesapeake Bay Preservation Area and the application of land use and stormwater management regulations on those lands. The following categories of preservation areas are to be designated:

- Resource Protection Area
- Resource Management Area
- Buffer Zone

Resource Protection Areas are to include:

- Tidal Wetlands
- Non-tidal Wetlands hydrologically connected by surface flow and contiguous to tidal wetlands or tributary streams.
- Tidal Shorelines
- Other lands as appropriate

- Buffer Zones (Vegetated) adjacent to and landward of the above areas and along both sides of tributary streams:

  - 100 feet (adjacent to tidal)

  - 50 feet (adjacent to non-tidal)

Resource Management Areas are to be designated contiguous to the entire RPA and are to include:

- Floodplains
- Highly erodible soils and steep slopes
- Highly permeable areas and areas vulnerable to groundwater degradation
- Non-tidal wetlands not in the RPA
- Other lands as appropriate

Major management requirements for the RPA, RMA, and Buffer include:

- After the effective date any lots platted must have sufficient area outside of the RPA, including the buffer, for all structures, driveways, etc.
- Disturb the minimum area during construction and use vegetative BMPs.
- Post development nonpoint source pollution cannot exceed pre-development conditions and redevelopment must result in a net ten percent (10%) reduction.
- No disturbance on non-tidal wetlands.

The following management requirement applies only in the RPA, including the buffer zone:

- No land development except water dependent facilities (non-water dependent ancillary structures and development must be outside the RPA) and redevelopment.

ELIZABETH RIVER STRATEGY

The preceding sections of this report have described water quality conditions in the Elizabeth River, discussed the impact of that water quality on critical resource habitats found in the basin, examined nonpoint source loadings compared to other

sources, described "typical watersheds" including BMP recommendations for those areas, and summarized recent legislative initiatives applicable to the preparation of an Elizabeth River stormwater management strategy.

Part Two of the 1986 Comprehensive Elizabeth River Water Quality Management Plan-Institutional Analysis and Land Use/Nonpoint Source Analysis described the institutional capability of local jurisdictions in the Elizabeth River Basin to respond to water quality issues as they relate to land use development and nonpoint source pollution. That work included documenting local land use development goals and regulatory measures as they relate to water quality issues. The compatibility of these goals and regulatory measures with water quality goals was analyzed. SVPDC has re-examined those conclusions and the status of implementation as part of this effort. Those results are included in Appendices A-C. In addition to the more recent legislative initiatives summarized above, that information as well as its re-examination in two of the companion reports prepared in support of this report (Appendix D and Appendix E) has also been considered in the preparation of the stormwater management recommendations which follow.

Further, the 1983 Hampton Roads Water Quality Agency update of the Hampton Roads Water Quality Management Plan included a detailed Nonpoint Source Control Program for the Hampton Roads Area. It also analyzed and reiterated many of the general water quality management recommendations, which were included originally in the HRWQMP. Those recommendations which remain valid and are applicable to the Elizabeth River are reflected in the stormwater management recommendations in this report. The reader desiring detailed documentation of the HRWQMP recommendations and their justification, is referred to those reports.

The basic structure of a stormwater quality management strategy for the Elizabeth River must meet the legislated minimum criteria of the EPA NPDES Stormwater Permit Regulations and the Virginia Chesapeake Bay Preservation Act. Local implementation of the minimum criteria of those mandates constitutes the minimum level stormwater management strategy. Many observers of water quality dynamics believe the CBPA approach to controlling pollutants from the land to be flawed. Specifically, the CBPA requires BMPs and other stormwater-borne pollutant reducing measures only within a very limited geographical area and does so primarily through land use and habitat protection controls. Comprehensive water quality studies have shown that nonpoint source loadings from all areas of a watershed may have significant water pollution consequences. In fact, the Commonwealth of Virginia has used scarce Chesapeake Bay clean-up funds to provide cost-share money for the implementation of animal waste control practices in the Shenandoah River basin, because of its link to the Bay via the Potomac River. Consequently, the second level of an Elizabeth River stormwater management strategy should be the establishment of local basin-wide stormwater management programs as authorized by the recent Virginia General Assembly action (Senate Bill 722/House Bill 1848). Implementation of such a stormwater management program

should require appropriate BMPs on all new construction activity within the Elizabeth River basin.

For localities desiring to take a more rigorous watershed-wide approach to stormwater quality management than that implicit to the above strategy, the following additional specific actions may be considered for inclusion in the local basin-wide stormwater management program:

- Routine storm drainage maintenance programs could be established to ensure the continued effectiveness of the best management practices required on all new development. Also, such a program should be implemented for existing drainage facilities.

- Local site plan review processes could include additional consideration of alternative site design practices useful in mitigating pollutant runoff induced by development. These could include clustering and other means of retaining open space.

- Rigorous implementation and enforcement of erosion and sediment control ordinances could be undertaken. In parallel, the Commonwealth should ensure that sanctions for violations are sufficient enough to encourage compliance with the ordinances.

- Local and state programs which encourage homeowners and others to properly dispose of toxic home chemicals, such as pesticides, paints, solvents and so forth could be conducted.

- NPS control could be considered as a factor in landscape designs for publicly-owned lands and in the landscape maintenance plans for such lands.

- Litter control programs could be expanded.

- Implementation of BMPs could be required for outside materials storage, such as, construction of shelters, perimeter dikes and other measures which prevent materials from leaving the site in stormwater.

- Runoff controls could be required at marinas to prevent residuals from boat maintenance being carried into receiving waters by stormwater. By requiring all hull scraping and painting to be conducted in an area surrounded by a perimeter dike would be one way to accomplish this. Periodic removal of residuals from the designated area and their proper disposal should also be required.

- The implementation of special controls on drydock discharges could be enhanced in accordance with the findings of site specific analyses.

- In implementing a more rigorous management program for the Elizabeth River, the relationship of water quality and land use management with other resource management programs should be recognized. These include Coastal Resources, Air Quality, and Solid and Hazardous Waste Management. Implementation efforts should be closely coordinated among these programs.

- Historically, many sites along the Elizabeth River have been used for waste disposal. These are discussed at length in Appendix G. In order to ensure that these sites do not contribute to future water quality and other environmental problems and do not adversely impact on new uses of these sites, test borings to determine the presence or absence of hazardous or toxic materials could be required as a condition of development approval. Site-specific management programs should be devised on the basis of the findings from these tests.

- Public education and information programs conducted by local, State, and regional agencies could be expanded. These programs focus on the good-housekeeping practices that can be implemented by homeowners and other residents. Opportunities to "piggyback" these programs with similar programs on Coastal Resources, Hazardous Waste and so forth may exist. They should be explored and used to the maximum extent possible.

- Local Wetlands Boards and the Virginia Marine Resources Commission should rigorously apply the Wetlands, Sand Dunes and Subaqueous Lands guidelines which have been developed by the VMRC and VIMS. These guidelines should be publicized and should serve as the basis for public education efforts.

- Public and private owners and operators of vehicle fleets could be required to institute maintenance programs to ensure proper operation of emissions controls, beyond the current minimums of the State's vehicle inspection program.

In support of local stormwater management actions, State assistance is needed in several areas. In addition to those described in other sections of this report, the following activities are necessary:

- State programs for providing technical assistance to landowners and local governments in their efforts to control nonpoint source pollution should be formalized. Specifically, the Chesapeake Bay Local Assistance Department (CBLAD), Virginia Water Control Board (VWCB), Virginia Council on the Environment and others should increase their level of financial support for local NPS control implementation.

- The State's oil recycling program should be continued and enhanced.

- The State (Virginia Institute of Marine Sciences) should update and publish the Tidal Wetlands Inventories for the Elizabeth River Basin. This would assist local Wetlands Boards and private landowners in carrying out their responsibilities under the Virginia Wetlands Act, as well as assist the locality in complying with the CBPA.

Additional studies which will assist in further defining stormwater management needs and solutions and which will also enhance their justification include the following:

- The State (Virginia Institute of Marine Sciences) should complete inventories of shellfish beds, fish nursery areas and prime submerged aquatic vegetation beds in the Elizabeth River. These inventories should not only identify the locations of such areas, but also the quality of the areas and their potential value assuming the river was made "fishable, swimmable". This would permit and justify the establishment of programs to protect these resources.

- Continued analysis of the effectiveness of best management practices through the Chesapeake Bay Initiatives and other programs along with extensive and timely distribution of that information.

- A full scale modelling exercise to enable decisionmakers to evaluate the most cost-effective means of accomplishing the forty percent (40%) nutrient reduction goal of the Chesapeake Bay Agreement, e.g. point source versus nonpoint source reductions.

ENDNOTES

[1]Chesapeake Bay Foundation, Convering Our Wetland Resources: Avenues for Citizen Participation, (Richmond, Virginia: CBF, 1987), p. 12.

[2]U.S. Army Corps of Engineers, Final Environmental Impact Report: Hampton Roads Energy Company's Portsmouth Refinery and Terminal, Portsmouth, Virginia (Norfolk, Virginia: COE, 1977).

[3]State Water Control Board, Public Leased and Condemned Shellfish-Growing Areas in the Commonwealth of Virginia, (Richmond, Virginia:SWCB), 1980, p. A-1.

[4]Hampton Roads Water Quality Agency, Hampton Roads Water Quality Management Plan: Public Hearing Draft (Virginia Beach, Virginia: HR WQA, 1978), p. 64.

[5]Virginia Institute of Marine Science, Water Quality Trends in the Lynnhaven Bay (Gloucester Point, Virginia: VIMS, 1982).

[6]Hampton Roads Water "Quality Management Study, Hampton Roads Water Quality Management Plan: Appendix 9 - Ecosystems Survey, (Virginia Beach, Virginia: HRWQA, 1976, p. 54.

APPENDIX G

HAZARDOUS WASTE SITES

IN

ELIZABETH RIVER BASIN

During the mid-1970s, increasing concern about the amount and effects of toxic pollution of the nation's waterways was expressed. Kepone in the James River and Mercury in the Shenadoah, among other problem areas, underscored this issue for Virginians. The Hampton Roads Water Quality Management Plan, completed in 1978, did not address toxic pollution in detail, due to funding limitations and guidance from the U.S. Environmental Protection Agency. The Plan did note, however, that toxic pollution appeared to be a critical problem in area water bodies and was probably significant enough to preclude many desired uses of these waters. It recommended that future sampling programs and regulatory efforts focus on the problem of toxics.[1] Subsequent studies by EPA, the SWCB, the HRWQA and the scientific community have provided documentation of the problem and reiterated the recommendation to increase control efforts.

Toxic pollution of the Elizabeth River is a recognized problem. The Corps of Engineers in its dredging and permitting programs has identified the need to provide confined storage of dredged materials from portions of the Elizabeth River, because the sediments do not meet EPA water quality criteria for ocean disposal. The EPA Chesapeake Bay Program has identified the Elizabeth River as one of the two most polluted basins in the Bay, primarily because of the presence of toxics in both the water column and the sediment. Much of this problem is believed to be historic in nature, the result of past river uses and disposal practices. However, recent studies indicate some continuing problems due to current land use activities in the Basin and continuing use of the River for commercial and military shipping.

Under both the federal and state Superfund Programs, owners of property become liable for environmental damage and cleanup associated with any hazardous materials or hazardous wastes on a property. The CERWQMP: PMR recommended that test borings and associated chemical analyses should be conducted at all potential development sites with a known or suspected history of having been a hazardous waste or toxic material disposal site. Although that recommendation has not been implemented, the private sector has taken the initiative to make similar determinations. As one element of background research into commercial and industrial property transfers, banks and mortgage companies frequently require an environmental audit. These audits are to determine whether the site contains residuals from past disposal activities or if surrounding properties may be used for activities involving hazardous wastes or materials. SVPDC experience indicates that this activity is increasing in frequency and in the depth of information gathering and analysis.

The CERWQMP: PMR addressed the question of nonpoint source toxic pollution of the Elizabeth River in a qualitative fashion. Based on identification of potential problem sites and known problems with antifoulant paints, it made a number of recommendations for specific actions to address these problems. As noted in Appendix A, a number of those recommendations have been implemented over the past three years. Through the Chesapeake Bay Agreement strategies and the SWCB Elizabeth River Initiative, action to address many of them is continuing.

This section updates the qualitative analysis contained in the CERWQMP: PMR to reflect recent studies and the results of related regulatory programs. It identifies the many existing uses that fall under one or more of the state and federal programs to manage the various facets of hazardous materials and wastes use and disposal. These are uses and activities of concern because of their potential to contribute to continuing unacceptable levels of toxicity in the River. This information should be viewed as a resource by local government officials for use in addressing potentially critical land use and nonpoint source management issues.

HAZARDOUS WASTE ACTIVITIES

Businesses that generate, transport or treat, store or dispose of hazardous wastes are required to notify the U.S. EPA and the Virginia Department of Waste Management of their hazardous waste activities. This notification and the related regulatory and management programs are mandated by the Resource Conservation and Recovery Act of 1976, as amended. Most of the region's heavy manufacturing and other large industries are included on the Master List of Notifiers. Ship repair, automobile manufacturing, chemicals, petroleum products and the military are included in this group. Many small businesses, including dry cleaning, automobile sales repair, optical equipment and scientific laboratories are also included.

Since 1986, the population of notifying industries in Southeastern Virginia has grown from eighty to more than 400.[2] Much of the growth has occurred in the small business category. This is attributable to the requirement, contained in the Hazardous and Solid Waste Amendments of 1984, for small quantity generators of hazardous waste to also notify the state and EPA of their activities. Small quantity generators are those businesses that generate from 100 to 1,000 kilograms of hazardous waste per month. Generators of less than 100 kilograms per month remain exempt from most aspects of the hazardous waste regulatory system. It is expected that, regardless of economic growth, the number of firms on the Master List will increase due to the continued strengthening of the hazardous waste regulatory system.

The CERWQMP: PMR noted that there were fifty-four businesses in the Elizabeth River Basin that were involved in hazardous waste activities and included on the state's Master List. Today, this number has grown to 252 businesses. These firms are depicted on Figure 1 and listed in Table 1. As is true of the region as a whole, most of these firms fall into the category of small generators. The 252 listed firms, which are located in the Elizabeth River Basin, constitute over 60% of the businesses involved in regulated hazardous waste activities in Southeastern Virginia. They include most of the region's firms involved in the transportation of hazardous waste. Of most significance is the fact that more than 75% (29) of the region's firms that are considered to be large generators (more than 1,000 kilograms per month) or firms that store or treat hazardous wastes are located in the basin. Many are located in close proximity to the Elizabeth River or one of its tributaries.

It is believed that the number of regulated firms in the basin is probably much greater than this list indicates. A 1986 analysis by the SVPDC indicated nearly three times as many businesses in the region would be regulated, based on application of national figures to the region's business mix. That analysis also indicated that approximately 3,750 businesses in the region generate less than 100 kilograms per month and, thus, were exempt from most of the regulatory system.[3] Based on their size and the distribution of commercial and industrial activities in the region, the percent of these, located in the Elizabeth River, would probably be less than is the case for the larger generators. The Southeastern Public Service Authority of Virginia is currently conducting a study of the need for and feasibility of a hazardous waste transfer station for this region. That study should result in the availability of improved estimates later in 1989.

UNDERGROUND STORAGE TANKS

The CERWQMP: PMR estimated the number of regulated underground storage tanks in the region. It was estimated that approximately 20% of the facilities with tanks in Virginia were located in Southeastern Virginia. This amounted to 4,400 facilities with approximately 12,320 tanks. Based on the EPA estimate that 10-35 per cent of all underground storage tanks are leaking, the number of leaking tanks in this region would range from 1,232 to 4,312. It was noted that a significant portion of the region's facilities with underground storage tanks and with leaking tanks would probably be found in the Elizabeth River Basin[4]. This assumption was based on the urban character of the basin as well as the age of many of the facilities located there.

No attempt has been made to update this estimate for this study. It is believed that this estimate is still a reasonable indicator of the magnitude of the potential for an underground storage tank problem in the basin. Based on the number of cleanup and tank replacement efforts, observed in the basin over the last several years, it appears that potential problems have and do exist. Leaking underground tanks are primarily a groundwater, rather than a surface water, problem. However, it appears that there may be potential for resulting groundwater cleanup efforts to contribute to surface water degradation.

HAZARDOUS MATERIALS

Title III of the Superfund Amendments and Reauthorization Act of 1986 established a new program for hazardous materials emergency planning and preparedness. The program includes requirements for community right-to-know and toxic chemical release reporting by industry.[5] All basin localities have established Local Emergency Planning Committees to develop the required emergency response plans and to fulfill their community right-to-know responsibilities. Initially, this program required businesses in the manufacturing

sector to provide routine information on chemical hazards present in the community to the LEPC, the state and the local fire department. Thresholds for this reporting were high - 10,000 pounds - for most chemicals. On a chemical-specific basis, some thresholds were established as low as one pound. The regulatory program calls for a phased approach to the establishment of lower thresholds. Also, as requirements for hazardous materials notification in the workplace, under the Occupational Safety and Health Administration, are tightened, more businesses will be covered by the SARA Title III requirements.

No attempt has been made during this study to identify the specific firms covered by the SARA Title III requirements. Local plans are still being finalized. As indicated in the preceding paragraph, coverage thresholds are decreasing and the number of firms, covered by the reporting requirements, is increasing. While there is presently an exemption from reporting for materials that are packaged for household use, it appears likely that virtually all businesses will be covered by one or more facets of this regulatory program. All businesses that are included on the preceding Master List for hazardous waste activities will be covered by the SARA Title III requirements.

POTENTIAL SUPERFUND SITES

EPIC Study

During 1986 and 1987, the U.S. Environmental Protection Agency conducted a reconnaisance study of the Elizabeth River Basin to develop an inventory of potential hazardous waste sites. As defined for that study, the Elizabeth River Basin included all of metropolitan Southeastern Virginia. The study area is shown on Figure 2. This effort was one element of a multi-agency effort to create an Elizabeth River watershed geographic information system data base. A follow-up study was conducted during 1988.

The initial study was completed by EPA's Environmental Photographic Interpretation Center (EPIC), based on a review of historical aerial photography. Sites of concern were identified on aerial photos covering the period from 1937 through 1986 and plotted on USGS 1:24,000 topographic maps. Identified sites included landfills, open dumping, auto junkyards, industrial storage and disposal areas, industrial waste impoundments, sewage treatment impoundments, dry docks, clusters of above ground tanks, and "other potential hazardous waste sites". The mapped boundaries of the sites reflected photo observation and did not indicate legal property boundaries. A tabular report and accompanying map atlas was prepared.

The EPIC Study indicated that the 432 square mile Elizabeth River study area (metropolitan Southeastern Virginia) included 649 potential hazardous waste sites. Figure 3 summarizes the number of sites in each potential site category by USGS quadrangle name. (The number of sites on this table is more than 649, because some

sites are counted in more than one category.) It was concluded that most sites were located in close proximity to the Elizabeth River and its tributaries. Based on comparing the historic photos, it was also noted that the potential sites have gradually moved away from the River itself as development has spread away from the River. No recommendations were included in this study.[6]

NUS Study

In 1988, EPA contracted with the NUS Corporation to conduct a followup to the EPIC Study. Categorized as a CERCLA (Superfund) site discovery project, this study constitutes Phase I of a long-term project to refine the National Priority List for the Superfund program. The project was viewed primarily as a site elimination effort. Sites were to be eliminated from the original list of 649 in the following sequence:

- Sites already on CERCLIS. It was noted that some sites on CERCLIS may remain on the list, because available location maps were not conclusive.
- Sites that are Treatment, Storage or Disposal (TSD) sites regulated under the Resource Conservation and Recovery Act (RCRA). Because of problems with data comparability, these sites were not eliminated.
- Sites that were "Blacked out" on the initial photos. Generally, these were sites on military lands. They remain candidates for consideration through the military cleanup programs.
- Other sites on federal facilities.
- Formal screening by site type. This resulted in the elimination from the Phase II study of auto junkyards, sewage treatment impoundments, dry docks, and tanks and containers. Such sites may be considered by EPA in future study efforts.

The last step in the elimination process involved an extensive review by staff from the SVPDC, Hampton Roads Water Quality Agency and the affected local governments. Although the consultant reviewed file information at the state regulatory agencies, it was noted that relatively little historical information was available except at the local level.

Figure 4 depicts the sites which were identified in the NUS Study for consideration in Phase II of the study effort. Figure 5 summarizes these sites by USGS quadrangle and type. As in the EPIC Study, the Elizabeth River Basin actually comprises all of metropolitan Southeastern Virginia. As EPA and its consultants prepare for Phase II of this study effort, a total of 285 potential hazardous wastes

must be investigated.[7] An additional 92 federal sites have been identified and must be investigated. The location and nature of the federal facilities are summarized in Figure 6. Of the remaining 377 sites (federal and civilian), 316 or 84% are clearly in the Elizabeth River Basin proper.

Inclusion in this group does not mean that sites are likely to be Superfund sites due to the presence of hazardous wastes. However, EPA believes that the potential is strong enough to merit further study. Other sites which were not apparent in the initial aerial photographic inventory may also merit investigation. Pending completion of the Phase II evaluation, it may be appropriate to subject any development proposed for these sites to a greater degree of scrutiny. Over the long-term, the potential impact of this historic activity on water quality and land use development must be considered in local planning and regulatory activities. Basin local governments have been provided with copies of the NUS Study for information and use.

USGS Study

Integrally related to the EPIC and NUS Studies was an effort by the U.S. Geological Survey to develop a geographic information system covering land use and water quality. A major component of that effort was to include the inventory of historic disposal sites. At the completion of the CERWQMP: PMR, it was believed that the USGS effort would be completed in early 1988. Recent discussions with USGS indicate that considerable work was, in fact, accomplished on this program. Much of the data has been digitized and entered into the ARC/INFO system. The data base includes topographic data, transportation, surface water resources, land use, the historic waste sites, and some hydrographic data. Incomplete data sets on both surficial and bedrock geology, soils and groundwater have also been entered into the system. Analytical work has not been completed. At the present time, USGS does not have funding or a schedule for completing this project. It should be noted that groundwater and geologic data are being included in the ARC/INFO system through another project. Analyses of hurricane flooding, using this system, are being undertaken through a separate project by the USGS and the Corps of Engineers.

DOD FACILITIES

The Department of Defense has completed a water quality assessment of its facilities in the Chesapeake Bay Region. This assessment looked at 66 DOD facilities in the region with potential for impacting water quality and living resources based on their size, proximity to the Bay or the type of activities undertaken at the facility. A total of 37 installations were determined to have the potential for significant impacts. The DOD study concluded that despite this potential, DOD facilities do not appear to be implicitly involved in the "far-field, long-term trends of declining environmental integrity in the Bay system." It was noted that the impacts of the facilities do not extend beyond the immediate vicinity of the installation. Ongoing

concerns include stormwater runoff, dispersed, intermittent sources of industrial (toxic) pollutants to sewage treatment systems and/or to storm drains and abandoned or inactive hazardous waste disposal sites. The latter was noted as potentially the most significant problem.

Recommended actions for DOD facilities, in general, included improved long-term, self-monitoring, nonpoint source pollution evaluation and management efforts, improved management of hazardous and toxic materials, and enhanced work with the regulatory agencies. This latter recommendation was addressed more at the regulatory agencies than the reverse.

The Elizabeth River is home to several of the Navy's largest and most heavily industrialized installations, including the Norfolk Naval Shipyard, Norfolk Naval Base (Sewells Point Complex), Norfolk Naval Air Station and related activities. The Sewells Point Complex and Norfolk Naval Shipyard were characterized as having the potential for significant impact on surface waters. Areas of concern for these facilities included:

- Migration of toxic contaminants from inactive waste disposal or past spill sites into local surface waters, with contaminant levels exceeding state and federal criteria;
- Poorly defined quality of discharges from storm drainage and miscellaneous industrial activities;
- Introduction of pollutants from ship maintenance activities; and,
- Existence of leaking underground fuel storage tanks.

The study categorized the Naval Supply Center - Craney Island as having probably significant, but poorly defined, impact potential for the same reasons. Based on available data, the St. Juliens Creek Annex was determined to have insignificant impact potential.[8] A variety of specific recommendations were included for each of these facilities. They are summarized on Figure 7.

LAND USE/ WATER QUALITY TOXICS RELATIONSHIPS

At the time of completion of the CERWQMP: PMR, the State Water Control Board contracted with Old Dominion University to conduct a study of the water quality impacts of toxic pollution associated with various land uses. Completed in Spring 1988, the ODU Study was designed to characterize the spatial patterns of various types of pollutants so that "hot spots" could be targeted for more detailed studies and management actions. The emphasis in the study was on the identification of relationships between water quality problems related to toxic substances and specific land uses.

Phase I of the study involved screening fifty-two sites using innovative sampling and collection techniques and various bioassay techniques to determine the presence and effects of toxic substances in the waters of the Elizabeth River. Based on the screening effort, twelve sites were identified for more detailed study during Phase II. Figure 8 depicts the sites studied in the two phases. Table 2 describes the land use characteristics of the sites.

The ODU Study reached eleven major conclusions and made several recommendations for future actions and studies. The following section highlights those conclusions and recommendations dealing with land use management. Conclusions about sampling and analytical techniques are not discussed.

Major conclusions about the presence and effects of toxic pollutants in the Elizabeth River and their relationship to land use activities include:

- Widespread and diverse biological and chemical effects were observed. Chemical contaminants displayed a variety of spatial patterns.

- The potential for ecological impacts appears to be site-specific. Urban runoff sites appeared to be associated with greater than average mutagenic activity and below average acute mortality. Oil terminals appeared to exhibit above average acute mortality. Essentially, this says that typical runoff is likely to have long-term adverse effects on aquatic resources rather than immediate impacts.

- Biological effects exhibited considerable temporal variation. The investigators attributed this, at least in part, to the classic "first flush" effect of stormwater runoff.

- Spatial variation patterns suggest that pollutants are dissipated or diluted with distance from the land use activity. Spatial distribution was complicated by the overlapping effects of the different land uses and by the interchange between the sediment and the water column.

- Ambient sampling sites had lower levels of biological effects than sites in close proximity to land use activities, suggesting that contaminants dissipated or were diluted as they moved away from their source.

- Although water quality conditions were poorer than the range of conditions observed in the Chesapeake Bay over the past several years, they appear to have improved since the 1970s. This was generally true for both conventional and priority pollutants.

- Land use activities with the most significant impacts for a wide range of contaminants included sites at or near Atlantic Wood, Virginia Power - Chesapeake Energy Center canal dike and NORSHIPCO - Brambleton.

- Because of the complexity of the River system, as manifested in the wide range of observed effects, a comprehensive management and control strategy will be necessary to address nonpoint source problems in the River.[9]

Based on these conclusions, the ODU Study recommended the following:

- Quantitative studies to evaluate contaminants associated with particular activities at the land use sites and toxics monitoring studies to identify new problem areas and to evaluate cleanup progress.

- A diversity of management/control strategies will be required to deal with the toxic effects of land use activities.

- Management schemes must consider a multiplicity of overlapping problem areas, both active and historic, rather than a few "hot spots".

- Temporal variation in pollutant loadings and effects due to seasonal changes in commercial, recreational and industrial activity, seasonal changes in the susceptibility of aquatic resources to pollution effects, stormwater inputs and climate must be considered in the design of management programs.

- Future quantitative studies must distinguish between point and nonpoint source effects.[10]

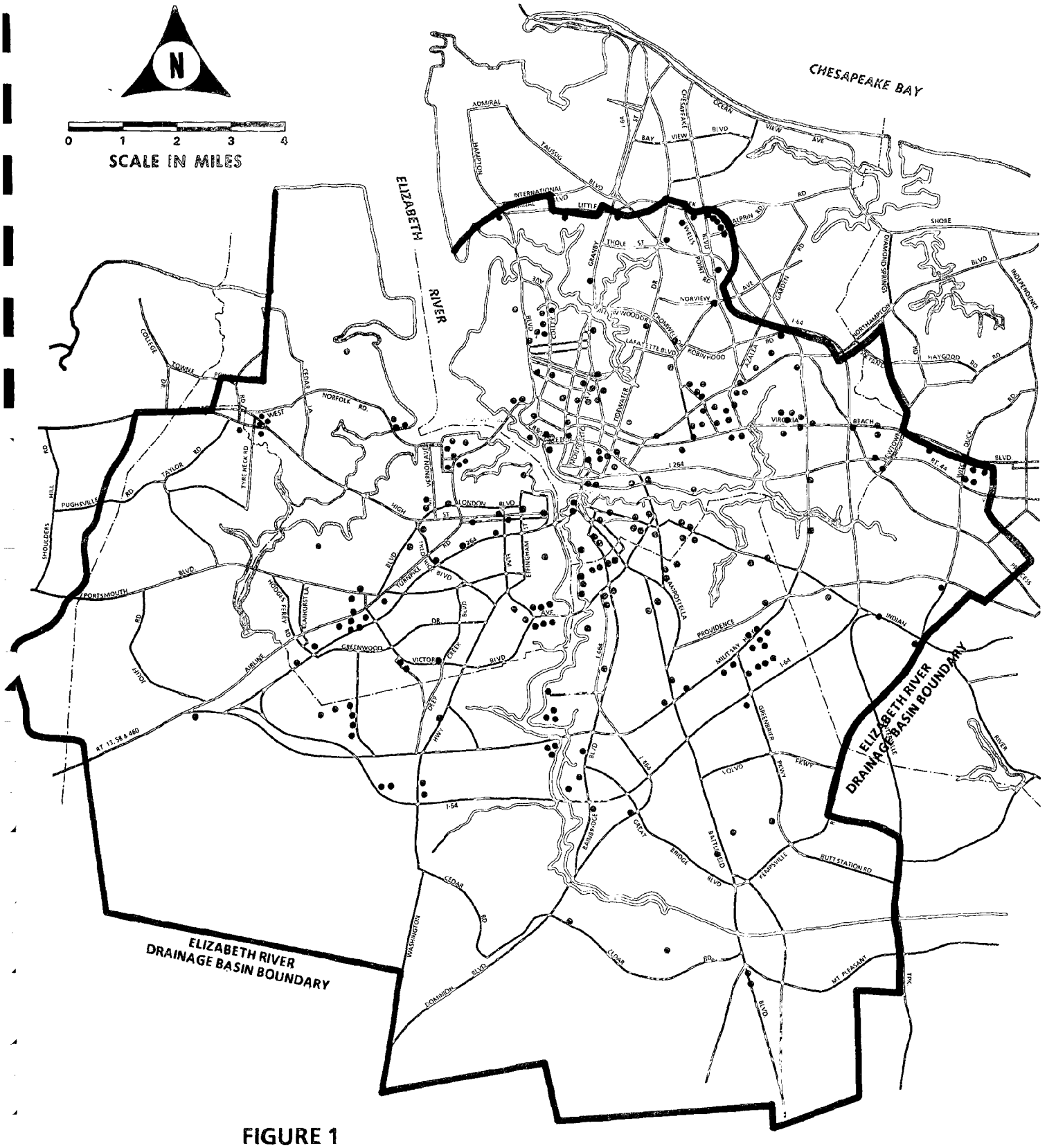


FIGURE 1
HAZARDOUS WASTE ACTIVITY NOTIFIERS
ELIZABETH RIVER BASIN

PREPARED BY SVPDC 1989
SOURCE: Department of Waste Management, Hazardous Waste Activity Notifiers, January, 1989

TABLE 1
PERMITTED HAZARDOUS WASTE GENERATORS, TRANSPORTERS AND DISPOSERS IN THE ELIZABETH RIVER BASIN

Facility Name	Type	Location
Aamco Transmissions	Q	Norfolk
Action Olds, Cadillac, GMC	Q	Portsmouth
Adams Outdoor Advertising	Q	Norfolk
Albano Cleaners - W. Branch	Q	Chesapeake
Albano Cleaners - Mil. Hwy	Q	Chesapeake
Albano Cleaners - Battlefield	Q	Chesapeake
Albano Cleaners - G.Wash. Hwy	Q	Chesapeake
Albano Cleaners - Bainbridge	Q	Chesapeake
Albano Cleaners - W. 25th St.	Q	Norfolk
Albano Cleaners - Tidewater Drive	Q	Norfolk
Albano Cleaners - W. Little Creek	Q	Norfolk
Albano Cleaners - E. Little Creek	Q	Norfolk
Albano Cleaners - St. Paul's	Q	Norfolk
Albano Cleaners - Va. Bch. Blvd.	Q	Norfolk
Albano Cleaners - Maple Ave.	Q	Norfolk
Albano Cleaners - 21st St.	Q	Norfolk
Albano Cleaners - Campostella Rd.	Q	Norfolk
Albano Cleaners - Colley Ave.	Q	Norfolk
Albano Cleaners - Sewells Pt. Rd.	Q	Norfolk
Albano Cleaners - Va. Bch. Blvd.	Q	Norfolk
Albano Cleaners - Monticello Ave.	Q	Norfolk
Albano Cleaners - W. 22nd Street	Q,T	Norfolk
Albano Cleaners - County St.	Q	Portsmouth
Albano Cleaners - Hamilton Ave.	Q	Portsmouth
Albano Cleaners - High St.	Q	Portsmouth
Albano Cleaners - Airline Blvd.	Q	Portsmouth
Albano Cleaners - Baker Road	Q	Va. Beach
Albano Cleaners - Kempsville Rd.	Q	Va. Beach

TABLE 1 (continued)

PERMITTED HAZARDOUS WASTE GENERATORS, TRANSPORTERS AND DISPOSERS IN THE ELIZABETH RIVER BASIN

Facility Name	Type	Location
Albano Cleaners - Level Green	Q	Va. Beach
Albano Cleaners - Providence Square	Q	Va. Beach
Albano Cleaners - 5316 Kemps River	Q	Va. Beach
Albano Cleaners - 5394 Kemps River	Q	Va. Beach
Altuf Corporation	Q	Norfolk
Amerada Hess Corp.	Q	Chesapeake
American Coastal Ind. Inc. ACI	Q	Chesapeake
American GFM Corp.	Q	Chesapeake
Amoco Oil Co.	Q	Chesapeake
Analysis & Technology, Inc. - 2 sites	Q	Chesapeake
Artlite Sign Co, Inc.	Q	Chesapeake
Associated Naval Architects	Q	Portsmouth
Astropak	G	Chesapeake
AT & T Long Lines Equip. Eng.	J	Norfolk
ATA Inc. T/A Pamper Cleaners	Q	Chesapeake
Atlantic Tankships	OM	Norfolk
Atlantic Wood Industries	C	Portsmouth
Atlantic X-Ray Service Inc.	T	Va. Beach
Atlantic Yacht Basin	Q	Chesapeake
Bauer Compressors, Inc.	Q	Chesapeake
Baumgardner	OFX	Chesapeake
Bay Chevrolet Corp.	Q,OFX	Norfolk
Bay Diesel Corp.	Q	Portsmouth
Bay Disposal	T	Norfolk
Bill Bruce Ford	G	Norfolk
Bill Lewis Chevrolet Corp.	Q	Portsmouth
Bob Ewell Tire Service, Inc.	Q	Portsmouth
Bock Drum	G	Norfolk

TABLE 1 (continued)

PERMITTED HAZARDOUS WASTE GENERATORS, TRANSPORTERS AND DISPOSERS IN THE ELIZABETH RIVER BASIN

Facility Name	Type	Location
Boiler Cleaning & Specialty	Q	Norfolk
Boulevard Cleaners	Q	Norfolk
Boulevard Motor Service	Q	Portsmouth
Boxer Rebellion	Q	Va. Beach
Browning-Ferris Industries	Q	Chesapeake
C & M Oil Distributors	OM	Chesapeake
Camellia Food Stores Coop, Inc.	Q	Norfolk
Car-Matic	Q	Norfolk
Carlectric, Inc	Q	Norfolk
Carter Machinery Co, Inc	Q	Chesapeake
Carter Machinery Co, Inc	Q	Norfolk
Castle VW/Mazda	Q	Norfolk
Cavalier Ford, Inc.	Q	Chesapeake
Channel Labs	Q	Norfolk
Chesapeake City Garage	Q	Chesapeake
Chevron USA, Inc.	Q	Norfolk
Churchland Cleaners	C	Portsmouth
Classic Fabricare	Q	Portsmouth
Cleanerama Cleaners	Q	Portsmouth
Cliff's Equip. Repair, Inc.	Q	Chesapeake
Coastal Equipment Corp.	Q, OS	Va. Beach
Colonial Chevrolet Corp.	Q	Norfolk
Colonial Cleaners	Q	Norfolk
Colonial Subaru	Q	Chesapeake
Colonna's Shipyard, Inc.	Q	Norfolk
Commercial Recycling Corp.	T	Chesapeake
Commonwealth Tractor & Equip.	Q	Norfolk
Compeco Dye Works	Q	Norfolk

TABLE 1 (continued)

PERMITTED HAZARDOUS WASTE GENERATORS, TRANSPORTERS AND

DISPOSERS IN THE ELIZABETH RIVER BASIN

Facility Name	Type	Location
Conoco, Inc.	G	Chesapeake
Conoly Phillips Lincoln-Mercury	Q	Norfolk
Crown Central Petroleum Corp.	C	Chesapeake
Culpepper Radiator Service, Inc.	Q	Portsmouth
Cumbia's Body Shop, Inc.	Q	Portsmouth
DePaul Medical Center	Q	Norfolk
Dirty Work, Inc.	Q,OG,T	Chesapeake
Con Comer Ford, Inc.	Q	Portsmouth
Dresser Industries (McGraw-Edison)	G	Chesapeake
Dresser-Rand	Q	Chesapeake
Eastern Auto Dist. Inc.	Q	Norfolk
Eastern Virginia Medical School	Q	Norfolk
Electric Motor & Construction	Q	Chesapeake
Exxon USA, Inc.	Q	Chesapeake
Exxon USA, Inc.	Q	Norfolk
Exxon USA, Inc.	Q	Norfolk
Exxon USA, Inc.	Q	Norfolk
Exxon USA, Inc.	Q	Norfolk
Exxon USA, Inc.	Q	Portsmouth
Exxon USA, Inc.	Q	Va. Beach
Fiat-Allis North American	G	Portsmouth
Ford Aerospace & Com. Corp.	Q	Norfolk
Ford Motor Co.	G	Norfolk
G. Marine Diesel of Va., Corp.	G	Norfolk
General Electric	Q	Chesapeake
General Foam Plastics Corp.	Q,OB,T	Norfolk
General Tire Service	Q	Norfolk

TABLE 1 (continued)

PERMITTED HAZARDOUS WASTE GENERATORS, TRANSPORTERS AND DISPOSERS IN THE ELIZABETH RIVER BASIN

Facility Name	Type	Location
Gene's Transmission	Q	Norfolk
Glidden Company	Q	Norfolk
Great Bridge Cleaners	Q	Chesapeake
Green-Gifford Motor Co.	Q	Norfolk
Greenbriar of Virginia	Q,OG	Chesapeake
Greenbrier Chrysler-Plymouth	Q	Chesapeake
Hagwood Laundry & Cleaners	Q	Portsmouth
Hagwood's Inc.	Q	Portsmouth
Heath Cleaners	Q	Norfolk
Heath New Look 1 Hr. Cleaners	Q	Norfolk
Hertz Penske Truck Leasing, Inc.	Q	Norfolk
Hi Dust 4 x 4 Inc.	Q	Norfolk
Hoescht Celanese - Spec. Chem.	G	Portsmouth
Holland, John C. Enterprises	T	Portsmouth
Huntsman Chemical Corp.	G	Chesapeake
Imported Car Centre, Inc.	G	Norfolk
Industrial Marine Services	Q,T	Norfolk
Ingram Auto Parts	Q	Norfolk
International Spring Corp.	Q	Portsmouth
James Cleaners	Q	Chesapeake
Johnnie Mizell Hauling	G	Chesapeake
Jonathon Corp.	Q	Norfolk
Kenan Transport Co.	G	Chesapeake
Kimnach Ford, Inc.	Q	Norfolk
Kline Chevrolet Sales Corp.	Q	Chesapeake
Leigh Memorial Hospital	Q	Norfolk
LeRoy's Cleaners	Q	Norfolk
Liberty Cleaners	Q	Norfolk

TABLE 1 (continued)

PERMITTED HAZARDOUS WASTE GENERATORS, TRANSPORTERS AND DISPOSERS IN THE ELIZABETH RIVER BASIN

Facility Name	Type	Location
Marine Controls, Inc.	Q	Norfolk
Marine Hydraulics Int'l., Inc.	Q	Norfolk
Marine Leasing Services, Inc.	T,FMS,T	Portsmouth
Marpol, Inc.	T	Norfolk
Matty's Auto Works	Q	Norfolk
McKendree and Co., Inc.	Q	Norfolk
McLean Contracting Co., Inc.	Q	Chesapeake
Merchant's Delivery Service	Q	Chesapeake
Metro Machine Corp.	G	Norfolk
Midway Radiator	C	Norfolk
Mobil Oil Co.	J	Chesapeake
Moon Engineering Co.	Q	Portsmouth
Moore's Waste Oil Service	OM	Chesapeake
Nissan Motor Corp., USA	Q	Norfolk
Norfolk & Western Railway	Q	Norfolk
Norfolk-Portsmouth Beltline RR	T	Portsmouth
Norfolk RERS, Inc.	Q	Norfolk
Norfolk Shipbuilding & DryDock	J	Norfolk
Norfolk Shipbuilding & DryDock	S/T	Norfolk
Norfolk Shipbuilding & DryDock	J	Norfolk
Norfolk Steel	G	Chesapeake
Norfolk Truck Center	Q	Norfolk
Norfolk, City Garage	J	Norfolk
Nu Car Carriers, Inc.	G	Norfolk
Ocean Imports Inc.	Q	Norfolk
Old Dominion University	Q	Norfolk
Overnite Transportation Co.	Q	Chesapeake
Parker Systems, Inc.	J	Chesapeake

TABLE 1 (continued)

PERMITTED HAZARDOUS WASTE GENERATORS, TRANSPORTERS AND

DISPOSERS IN THE ELIZABETH RIVER BASIN

Facility Name	Type	Location
Parkway Pontiac - Volvo, Inc.	Q	Chesapeake
People's Cleaners, Inc.	Q	Norfolk
Perkins Auto-Truck Repair	Q	Chesapeake
Perry Buick Co.	Q	Norfolk
Petrochem Recovery Services, Inc.	T	Norfolk
Plasser American Corp.	Q	Chesapeake
Portsmouth Public Schools	Q	Portsmouth
Portsmouth Tool & Die Corp.	Q	Portsmouth
Portsmouth, City of	C	Portsmouth
Portsmouth City School Garage	Q	Portsmouth
Portsmouth City School Garage	Q	Portsmouth
Preston Trucking Company	C	Norfolk
Procter & Gamble Mfg. Co.	S/T	Portsmouth
Quality Boats Co., Inc.	Q	Portsmouth
RAJ Chemicals of Virginia, Inc.	J	Chesapeake
Reactives Management Corp.	T	Chesapeake
Regency Olds	Q	Chesapeake
Richall Motor Company Inc.	Q	Norfolk
Riddle Honda	Q	Portsmouth
Roughton Pontiac - Subaru	Q	Norfolk
Royster Co. - S. Norfolk	S/T	Chesapeake
Royster Co. - Money Point	S/T	Chesapeake
Ryder Truck Rental, Inc.	Q	Chesapeake
Ryder Truck Rental, Inc.	Q	Norfolk
Ryder Truck Rental, Inc.	Q	Portsmouth
Safety-Kleen	S/T	Chesapeake
Sales Systems Limited	Q	Portsmouth
Seagraves Coatings - Seaguard	Q	Portsmouth

TABLE 1 (continued)

PERMITTED HAZARDOUS WASTE GENERATORS, TRANSPORTERS AND DISPOSERS IN THE ELIZABETH RIVER BASIN

Facility Name	Type	Location
Sealand Service, Inc.	G	Portsmouth
Southeastern Public Service Auth.	Q	Portsmouth
Southern Atlantic Label Co.	Q	Chesapeake
Southland Industries, Inc.	G	Chesapeake
Standard Forms, Inc.	Q	Norfolk
Strategic Alloys, Inc.	Q	Portsmouth
Suburban Grading & Utilities	Q	Norfolk
Sun Refining and Marketing	Q	Norfolk
Superior Eng. & Electronics	Q	Norfolk
Superior Eng. & Electronics	Q	Norfolk
T.C. Williams Cleaner	Q	Norfolk
Tabet Manufacturing Co., Inc.	Q	Norfolk
Tarmac - Lone Star Campostella	Q	Norfolk
Tarmac - Lone Star Money Point	Q	Chesapeake
Tarmac - Lone Star Va. Shipyard	Q	Norfolk
Tarmac - Lone Star Bells Mill	Q	Chesapeake
Tarmac - Lone Star Port Norfolk	Q	Portsmouth
Teagle & Little Printing Co.	Q	Norfolk
Tenneco Oil Co.	J	Chesapeake
Texaco Refining & Marketing	J	Chesapeake
Tidewater Auto Painting	Q	Chesapeake
Tidewater Community College	Q	Chesapeake
Tidewater Dodge, Inc.	G	Norfolk
Tidewater Regional Transit	Q	Norfolk
Tidewater Regional Transit	Q	Norfolk
Tidewater Steel Co.	Q	Chesapeake
Todd Marine Enterprises	Q	Norfolk

TABLE 1 (continued)

PERMITTED HAZARDOUS WASTE GENERATORS, TRANSPORTERS AND

DISPOSERS IN THE ELIZABETH RIVER BASIN

Facility Name	Type	Location
Tower Toyota Dodge	Q	Portsmouth
Transmission Engineering Co.	Q	Chesapeake
Tru-Green Corp.	Q	Norfolk
Truck Refrigeration Repair	Q	Norfolk
U.S. Coast Guard Support Center	G	Portsmouth
U.S. GSA Supply Center	J	Norfolk
U.S. Navy - Drug Screening Lab.	Q	Norfolk
U.S. Navy - Naval Base	S/T,T	Norfolk
U.S. Navy - Naval Shipyard	S/T,N	Portsmouth
U.S. Navy - Naval Shipyard	G	Portsmouth
U.S. Navy - Naval Shipyard	S/T,T	Portsmouth
U.S. Navy Regional Medical Center	Q	Portsmouth
U.S. NOAA Atlantic Marine Center	Q,OG	Norfolk
U.S. Postal Service - Veh. Maint	Q	Norfolk
U.S. Postal Service - Veh. Maint	Q	Norfolk
Unifirst Corp.	Q	Norfolk
Unocal	Q	Chesapeake
Va. International Terminals	Q	Norfolk
Va. International Terminals	Q	Portsmouth
Va. National Guard Shop 5	Q	Norfolk
Va. National Guard Shop 6	Q	Portsmouth
Valjar, Inc.	Q	Norfolk
Victory Motors, Inc.	Q	Portsmouth
Virginia Power	Q	Chesapeake
Virginia Power	Q	Norfolk
Virginia Power - Energy Center	Q,OSU	Chesapeake
Volvo Bus of North America	Q	Chesapeake

TABLE 1 (continued)

PERMITTED HAZARDOUS WASTE GENERATORS, TRANSPORTERS AND DISPOSERS IN THE ELIZABETH RIVER BASIN

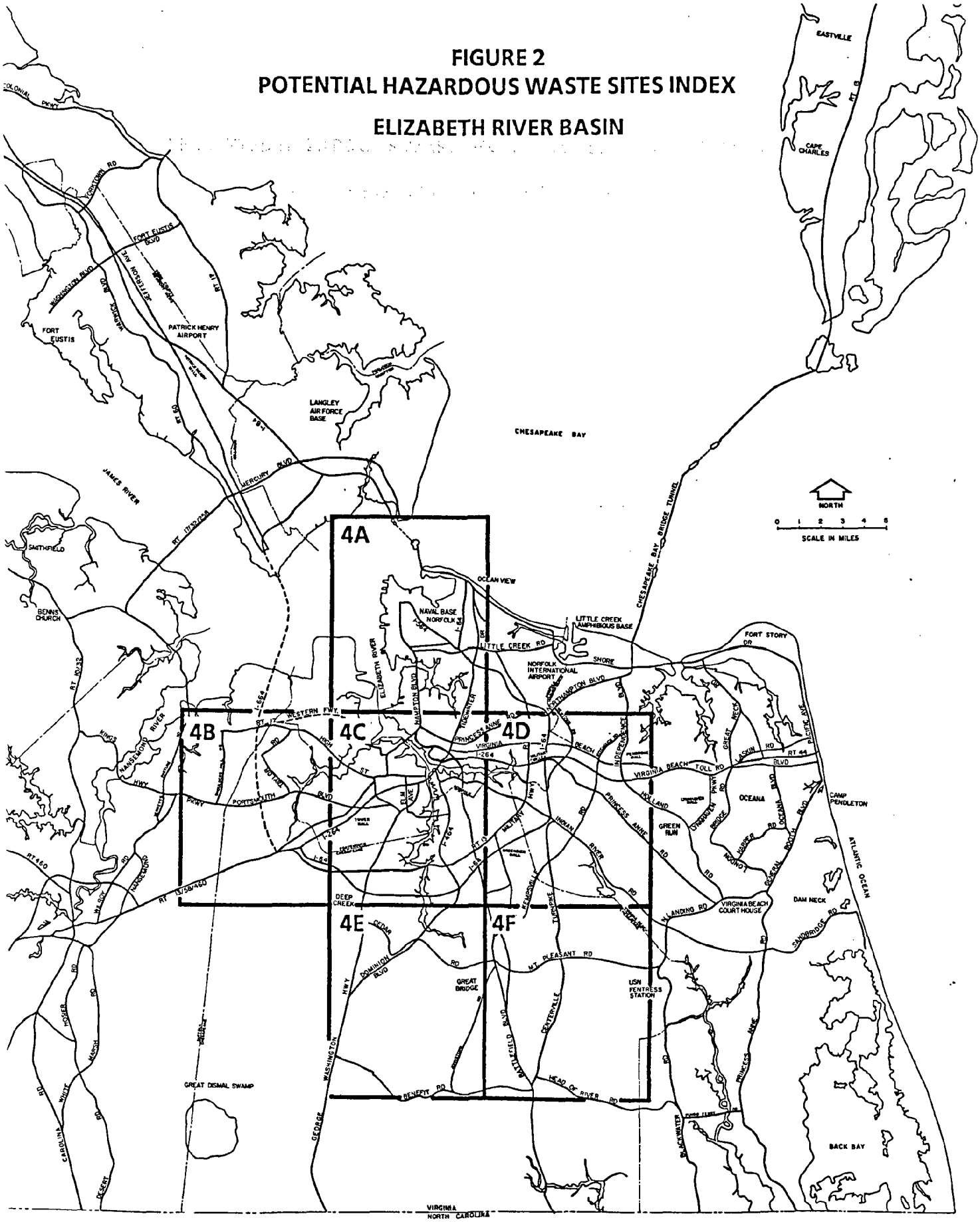
Facility Name	Type	Location
W.L. Black & Associates	G,T	Chesapeake
Wayside Cleaners	Q	Portsmouth
Western Branch Diesel, Inc.	Q	Portsmouth
Westwood Cleaners	Q	Chesapeake
Westwood Cleaners	Q	Portsmouth
Westwood Cleaners	Q	Portsmouth

Legend

G - Generator
Q - Small Quantity Generator
C - Small Quantity Generator (Conditionally Exempt)
J or N - Non-generator
T - Transporter
S/T - Store/Treat Facility
F,O,B, - Waste Fuel/Oil Generator, Marketer or Burner

SOURCE: Commonwealth of Virginia, Hazardous Waste Activity Notifiers. Richmond, Virginia: Department of Waste Management, January 1989.

FIGURE 2
POTENTIAL HAZARDOUS WASTE SITES INDEX
ELIZABETH RIVER BASIN



BASE MAP - PREPARED BY SOUTHEASTERN VIRGINIA PLANNING DISTRICT COMMISSION

FIGURE 3

POTENTIAL HAZARDOUS WASTE SITES

ELIZABETH RIVER AREA PRELIMINARY LISTING

	SITE TYPES										
Quadrangle	Landfill	Open Dumping	Auto Junkyard	Industrial Storage & Disposal	Industrial Wastewater Impoundment	Sewage Treatment Impoundment	Drydock	Tanks	Point Source	Other	Total Actual Sites
Newport News South	0	0	0	0	0	0	0	0	0	0	0
Bowers Hill	1	3	9	7	0	2	0	5	0	1	25
Lake Drummond NW	0	0	0	0	0	0	0	0	0	0	0
Norfolk North	4	1	5	10	8	2	0	24	0	4	56
Norfolk South	19	45	23	60	46	4	8	86	24	19	321
Deep Creek	1	3	1	6	4	1	0	8	0	0	22
Little Creek	1	6	4	1	2	3	0	8	0	1	25
Kempsville	7	14	10	43	10	17	0	48	0	11	136
Fentress	1	0	0	0	0	1	0	2	0	0	4
Cape Henry	0	0	2	2	0	1	0	2	0	0	6
Princess Anne	0	3	8	2	4	7	0	8	0	0	31
Pleasant Ridge	0	0	1	0	1	0	0	0	0	0	2
Virginia Beach	1	2	3	1	4	3	0	6	0	1	21
North Bay	0	0	0	0	0	0	0	0	0	0	0
Total	35	77	66	132	79	41	8	197	24	37	649

Note: Potential hazardous waste sites summarized by site type and quadrangle map name; mixed site types are counted once for each type present, so site type totals slightly exceed total actual sites.

Source: U.S. EPA, Inventory of Potential Hazardous Waste Sites - Elizabeth River Area, Virginia: Volume I, 1987.

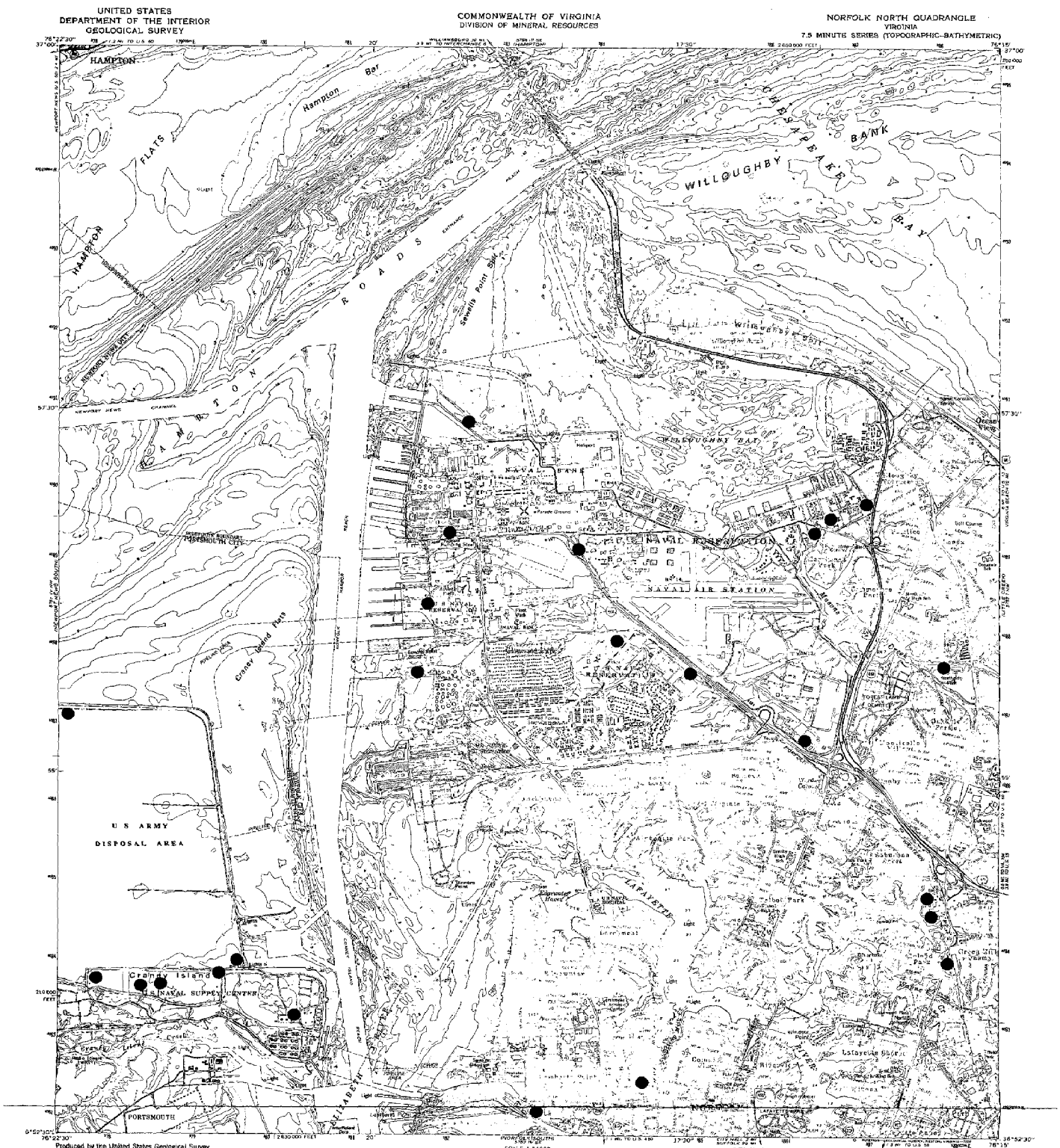


FIGURE 4A
POTENTIAL HAZARDOUS WASTE SITES
USGS - NORFOLK NORTH, VA.

ELIZABETH RIVER BASIN
PHASE II CANDIDATE SITES

PREPARED BY SVPDC 1989

SOURCE: NUS Corporation, Special Project Report - Phase I for Elizabeth River Study, 1988.

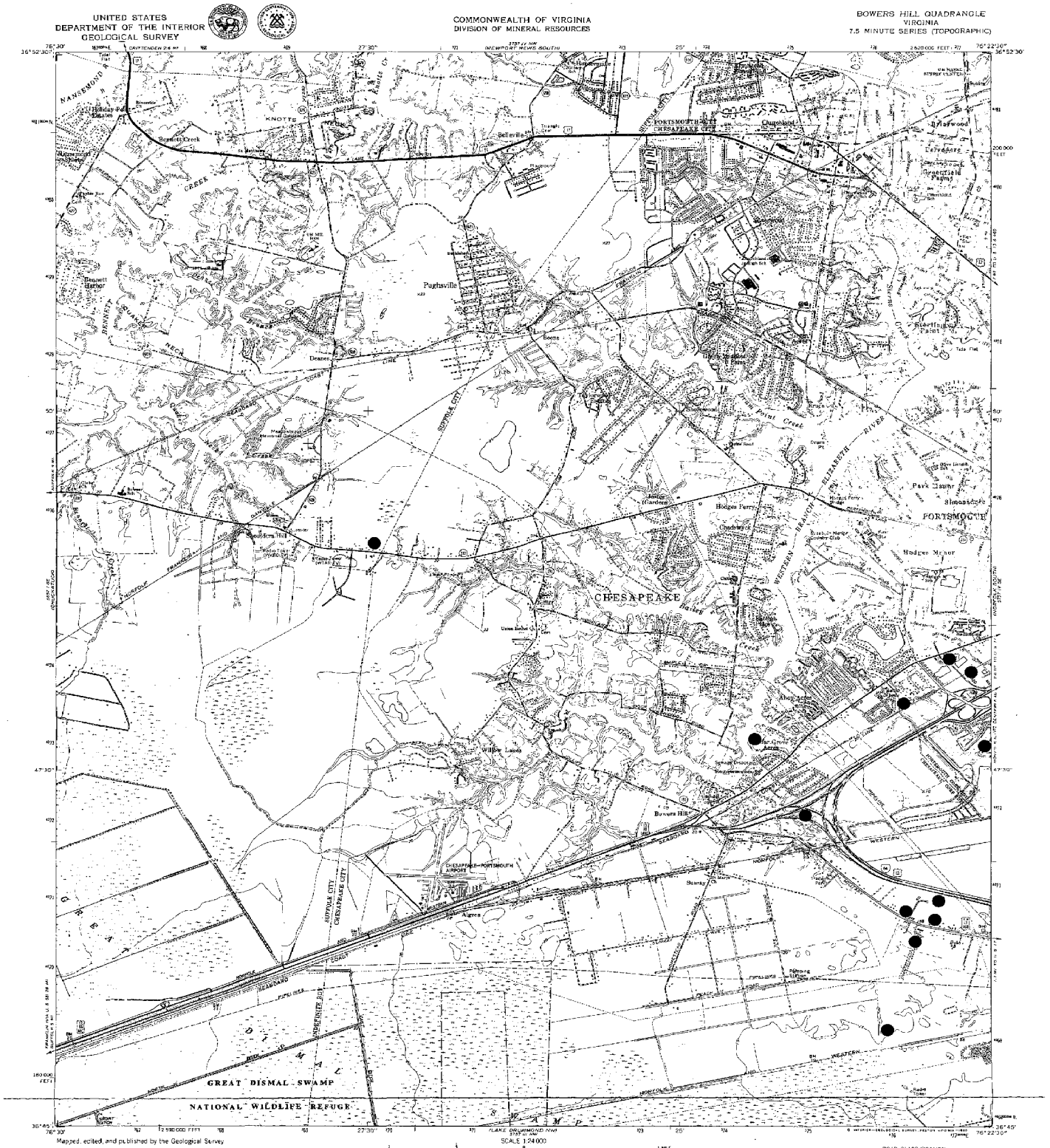


FIGURE 4B
POTENTIAL HAZARDOUS WASTE SITES
USGS - BOWERS HILL, VA.

ELIZABETH RIVER BASIN
PHASE II CANDIDATE SITES

PREPARED BY SVPDC 1989
SOURCE: NUS Corporation, Special Project Report - Phase I for Elizabeth River Study, 1988.

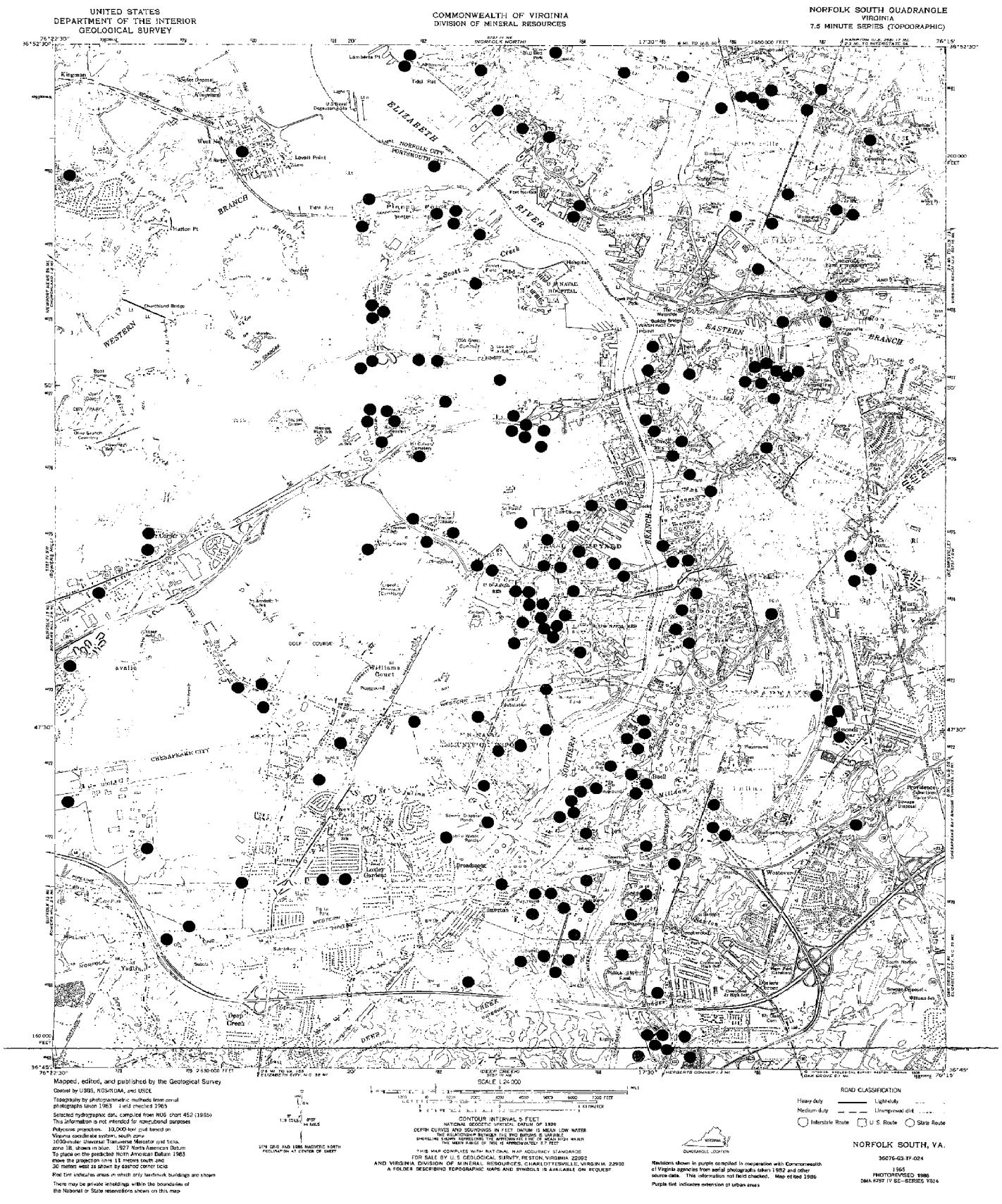


FIGURE 4C
POTENTIAL HAZARDOUS WASTE SITES
USGS - NORFOLK SOUTH, VA.

ELIZABETH RIVER BASIN
PHASE II CANDIDATE SITES

PREPARED BY SVPDC 1989
SOURCE: NUS Corporation, Special Project Report - Phase I for Elizabeth River Study, 1988.

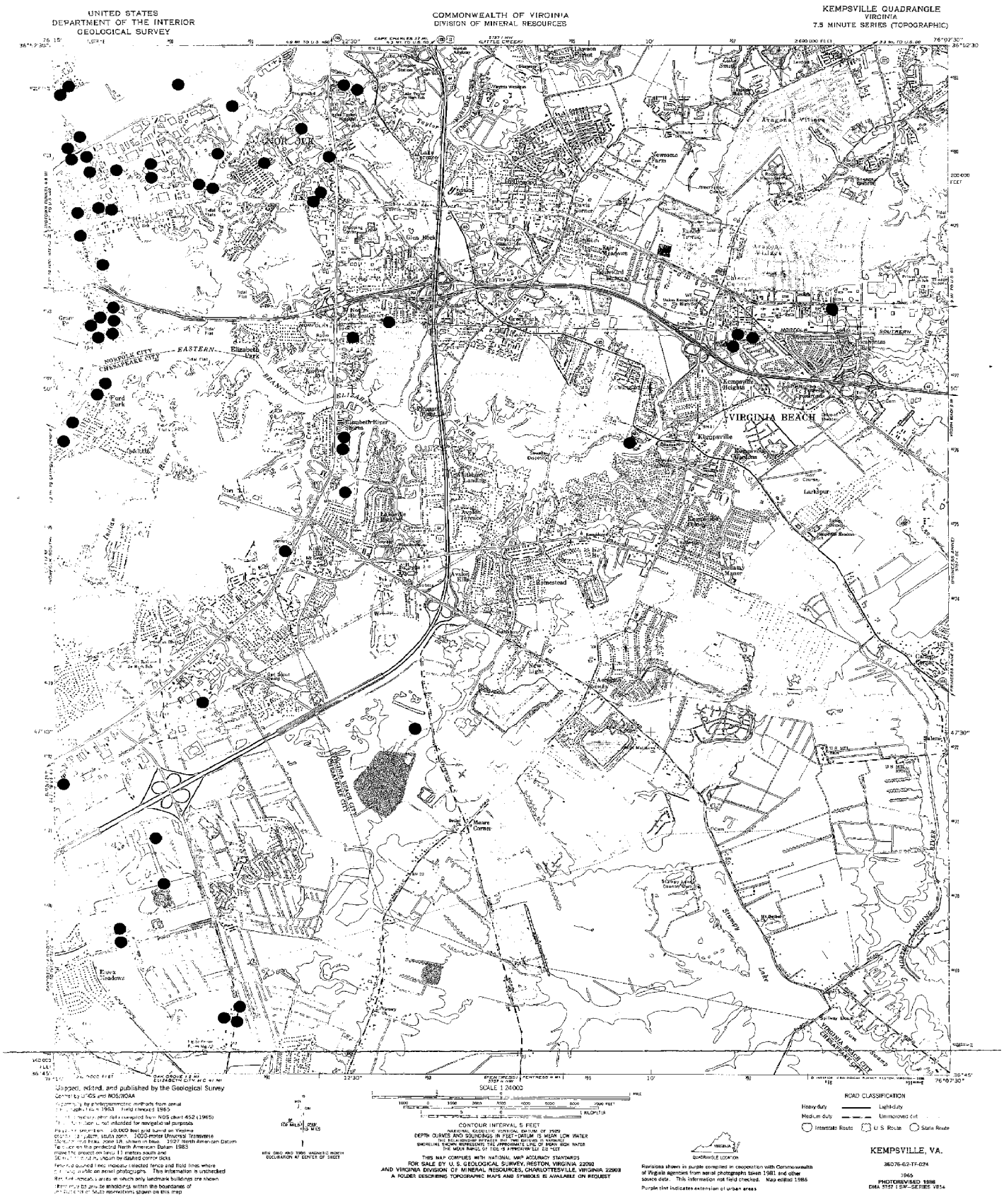


FIGURE 4D
POTENTIAL HAZARDOUS WASTE SITES
USGS - KEMPSVILLE, VA.

ELIZABETH RIVER BASIN
PHASE II CANDIDATE SITES

PREPARED BY SVPDC 1989

SOURCE: NUS Corporation, Special Project Report - Phase I for Elizabeth River Study, 1988.

FIGURE 4E
POTENTIAL HAZARDOUS WASTE SITES
USGS - DEEP CREEK, VA.

ELIZABETH RIVER BASIN
PHASE II CANDIDATE SITES

PREPARED BY SVPDC 1989

SOURCE: NUS Corporation, Special Project Report - Phase I for Elizabeth River Study, 1988.

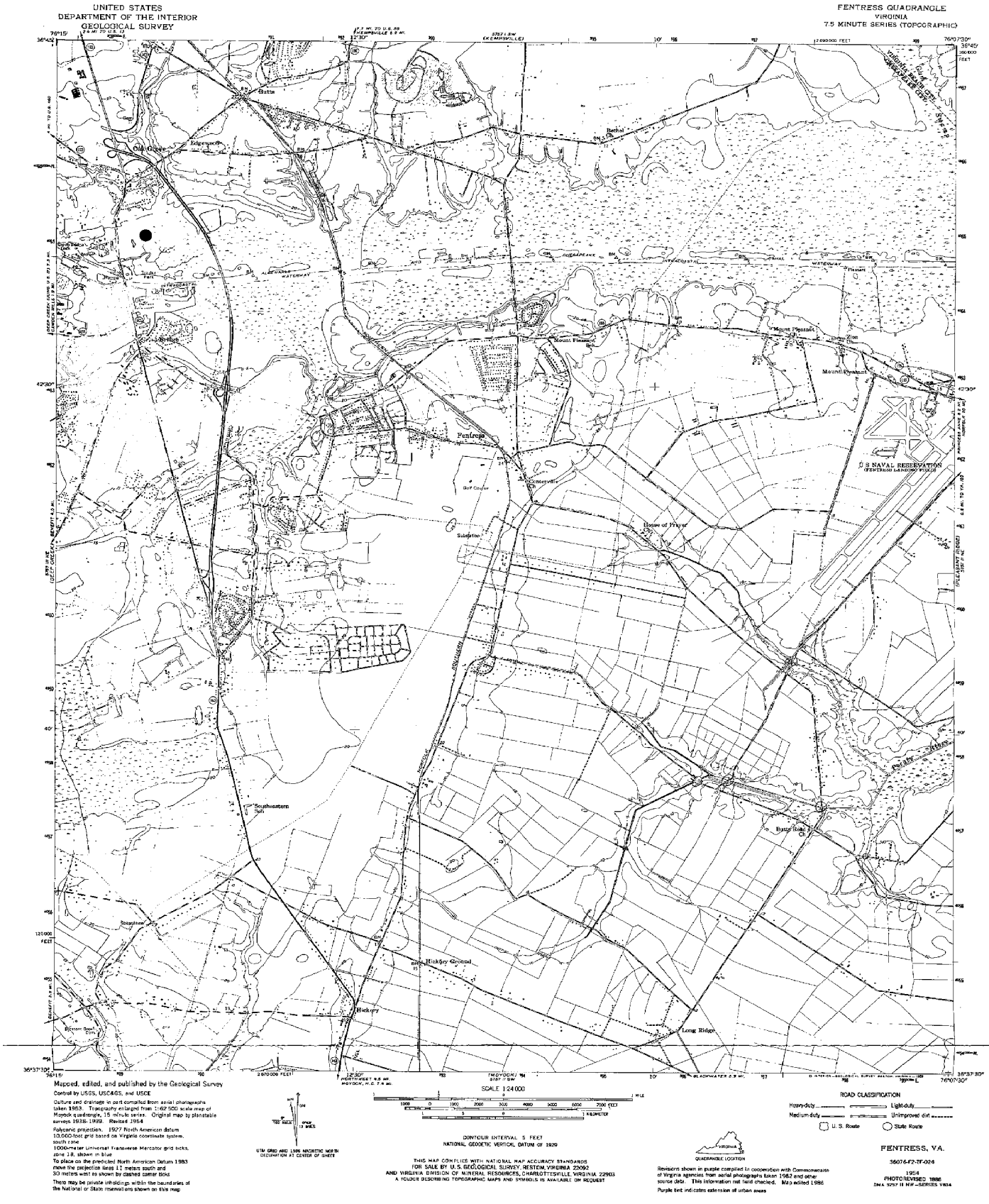


FIGURE 4F
POTENTIAL HAZARDOUS WASTE SITE
USGS - FENTRESS, VA.

ELIZABETH RIVER BASIN
PHASE II CANDIDATE SITES

PREPARED BY SVPDC 1989

SOURCE: NUS Corporation, Special Project Report - Phase I for Elizabeth River Study, 1988.

FIGURE 5

POTENTIAL HAZARDOUS WASTE SITES

ELIZABETH RIVER AREA PHASE I SCREENING - CIVILIAN

Quadrangle	SITE TYPE: Landfills	Open Dumping	Industrial Storage & Disposal	Industrial Wastewater Impoundment	Point Source	Other	Total Actual Sites
Newport News South	0	0	0	0	0	0	0
Bowers Hill	1	3	7	0	0	1	12
Lake Drummond NW	0	0	0	0	0	0	0
Norfolk North	1	0	3	3	0	0	7
Norfolk South	15	40	47	34	19	15	167
Deep Creek	0	3	5	3	0	0	11
Little Creek	0	2	0	0	0	1	3
Kempsville	7	12	37	9	0	9	67
Fentress	1	0	0	0	0	0	1
Cape Henry	0	0	1	0	0	0	1
Princess Anne	0	2	2	3	0	0	1
Pleasant Ridge	0	0	0	1	0	0	1
Virginia Beach	1	1	1	4	0	1	8
North Bay	0	0	0	0	0	0	0
Total*	26	63	103	57	19	27	279

*Site types total equals 295 sites due to some mixed site types for an individual site.

Source: NUS Corporation, Special Project Report - Phase I for the Elizabeth River Study, 1988.

FIGURE 6

POTENTIAL HAZARDOUS WASTE SITES

ELIZABETH RIVER AREA PHASE I SCREENING - MILITARY

Quadrangle	Federal Facility	Blacked Out On Imagery	Total
Newport News South	0	0	0
Bowers Hill	0	0	0
Lake Drummond NW	0	0	0
Norfolk North	17	17	34
Norfolk South	27	0	27
Deep Creek	2	0	2
Little Creek	16	0	16
Kempsville	1	0	1
Fentress	0	0	0
Cape Henry	2	0	2
Princess Anne	8	0	8
Pleasant Ridge	0	0	0
Virginia Beach	2	0	2
North Bay	0	0	0
Total	75	17	92

Source: NUS Corporation, Special Project Report - Phase I for the Elizabeth River Study, 1988

FIGURE 7

RECOMMENDED CLEANUP ACTIONS

DOD INSTALLATIONS/FACILITIES ELIZABETH RIVER BASIN

Recommendation	INSTALLATION/FACILITY Craney Island	Norfolk Naval Shipyard	Sewells Point Complex
ABANDONED SITES			
Proceed with next round of Confirmation Study sampling and testing.	X	X	X
Eliminate/control/treat leachate from landfills.	-	-	-
Implement containment control measures as outlined in Confirmation Study.	-	X	-
Confirm containment /migration of POL floating on groundwater or in soil near tanks.	X	X	-
Implement Confirmation Study at site(s) identified in IAS.	-	-	-
IMPERVIOUS AREA RUNOFF			
Oil/water separators are needed to intercept impervious area runoff.	-	-	-
Upgrade oil/water sparators to handle high wet weather runoff, high tides.	X	-	-
Institute surface water monitoring program to determine presence and need for control of contaminants.	-	-	X
EROSION/SILTATION			
Control soil erosion in and around landfills.	-	-	-
Implement Best Management Practices for erosion control and soil conservation.	-	-	-
UNDERGROUND STORAGE TANK STATUS			
Test suspicious tanks for leaks; or implement testing in accordance with state/federal regulations as they become effective.	X	X	-
Remove POL saturated soils surrounding tanks or in drainage ditches to prevent surface water transport.	X	X	-
Implement recommendations to clean up leaked POL product.	X	-	-

FIGURE 7 (Continued)

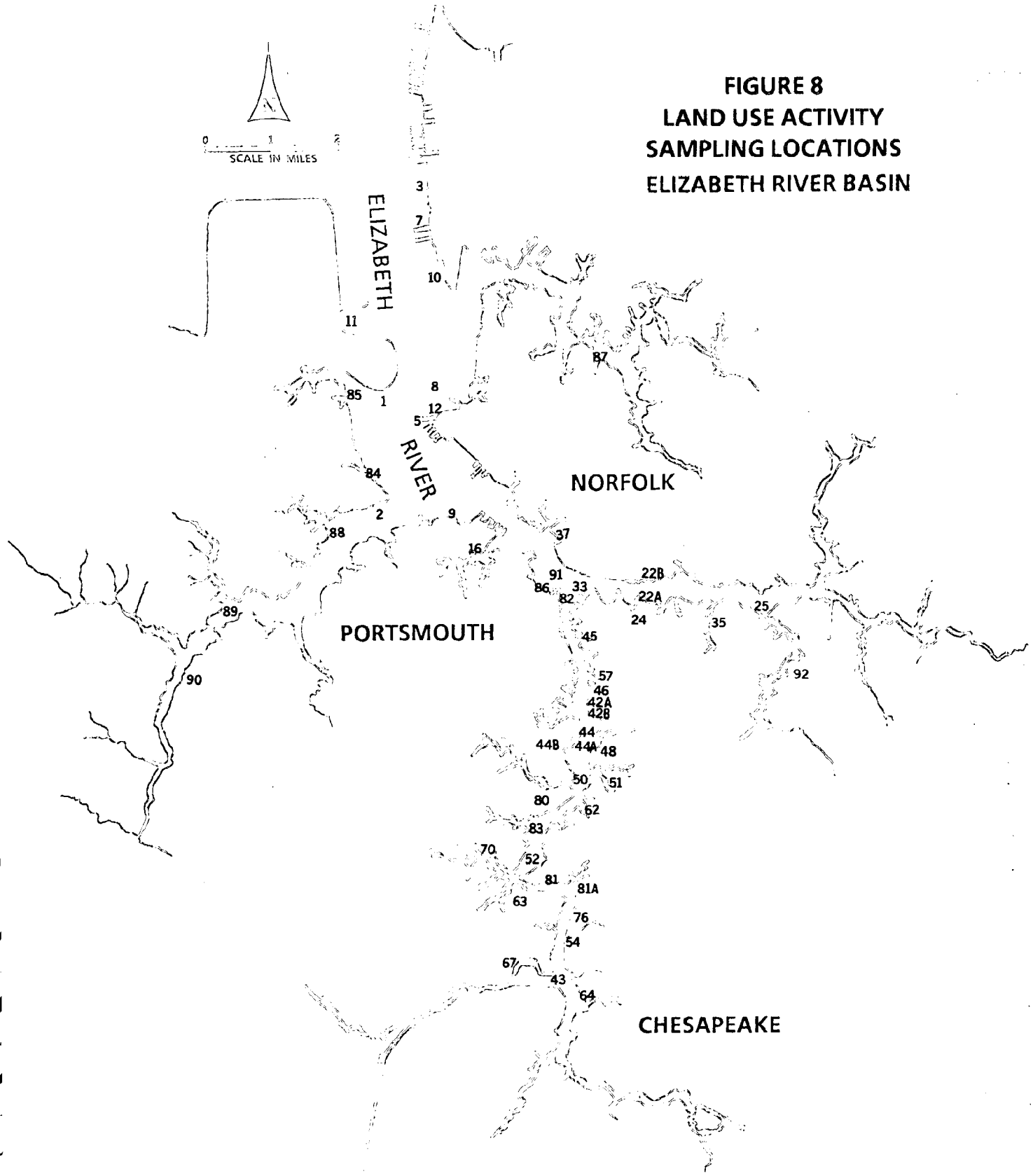
RECOMMENDED CLEANUP ACTIONS

DOD INSTALLATIONS/FACILITIES ELIZABETH RIVER BASIN

Recommendation	INSTALLATION/FACILITY		
	Craney Island	Norfolk Naval Shipyard	Sewells Point Complex
COMBINED STORM DRAINS			
Isolate and connect industrial discharges to local or installation waste treatment system.	-	-	X
Monitor effluent during dry weather to determine need for control or elimination.	-	-	X
INDUSTRIAL WASTE TREATMENT			
Obtain NPDES permit and/or monitor discharge as required by NPDES permit.	-	-	-
Install/service/upgrade oil/water separators to intercept effluent.	-	-	-
Install/upgrade pretreatment systems prior to discharge.	-	X	-
Review pretreatment process and operations to improve effluent quality.	-	X	X
Implement an effluent toxics monitoring program to determine pretreatment needs, if any.	-	X	-
REFUELING OPERATIONS			
Provide containment and spill prevention measures as required.	-	-	X
HAZARDOUS WASTE			
Implement/upgrade HM/HW management plan specific to this installation.	-	X	-
Provide a conforming HW storage/facility for the installation.	-	-	-
Re-evaluate management plan for more comprehensive HM/HW control.	-	X	-
Provide for disposal of hazardous waste sludge not under DPDO jurisdiction.	-	X	-
SPCC STATUS			
Implement an updated SPCC plan in accordance with environmental regulations.	-	-	-
Follow SPCC plans in handling abandoned fuel tanks to precent spill or leaks.	-	-	-

Source: Tetra Tech, Inc. Water Quality Assessment of DOD Installations/Facilities in the Chesapeake Bay Region, 1987.

FIGURE 8
LAND USE ACTIVITY SAMPLING LOCATIONS
ELIZABETH RIVER BASIN



NOTE: NUMBERS REFER TO TABLE 2

PREPARED BY SVPDC 1989

SOURCE: Old Dominion University, An Evaluation of the Distribution of Toxicants/Mutagens in the Elizabeth River, Virginia in Relation to Land Use Activities, 1988.

TABLE 2

LAND USE ACTIVITY SITES

FOR

PHASE I AND PHASE II SAMPLING

Site #	Site Name	Land Use Activity Category
1	Craney Is. Naval Supply	Military
2	Virginia Chemicals	Chemical Processing
3	Exxon	Oil Terminal
5	Lamberts Point Coal Loading	General Industrial and Commercial
7	Army Base STP Outfall	POTW
*8	Lamberts Point STP Outfall	POTW
9	Pinners Point STP Outfall	POTW
10	Norfolk International Terminal	General Industrial and Commercial
11	Craney Is. Rehandling Basin	Landfills and Disposal Areas
12	Lamberts Point Drainage	Landfills and Disposal Areas
*16	Scotts Creek	Marina & Dock Areas
*22A	NORSHIPCO - Brambleton	Shipyards
22B	NORSHIPCO - Brambleton	Shipyards
*24	Colonna's Shipyard	Shipyards
25	Ford Plant	General Industrial and Commercial

TABLE 2 (continued)

LAND USE ACTIVITY SITES

FOR

PHASE I AND PHASE II SAMPLING

Site #	Site Name	Land Use Activity Category
33	Metro Machine	Shipyards
35	Campostella Landfill	Landfills and Disposal Areas
37	The Hague	Urban Runoff
42A	Norfolk Naval Shipyard #1	Shipyards
42B	Norfolk Naval Shipyard #2	Shipyards
*43	Virginia Power (Dike)	General Industrial and Commercial
*44	Royster	Chemical Processing
*44A	Atlantic Wood (Ditch)	Chemical Processing
44B	Atlantic Wood	Chemical Processing
*45	NORSHIPCO - Berkeley	Shipyards
46	Tropicana	Oil Terminal
48	Amoco	Oil Terminal
50	Cargill	Chemical Processing
51	Gilligan Creek	Urban Runoff
52	Tenneco	Oil Terminal
54	Weaver Fertilizer	Chemical Processing

TABLE 2 (continued)

LAND USE ACTIVITY SITES

FOR

PHASE I AND PHASE II SAMPLING

Site #	Site Name	Land Use Activity Category
57	Seahorse Marine	General Industrial and Commercial
62	Norfolk & Western Rwy.	General Industrial and Commercial
*63	Swan Oil	Oil Terminal
64	Huntsman Chemical	Chemical Processing
67	Virginia Power (Canal)	General Industrial and Commercial
70	St. Juliens Creek	Military
76	Smith-Douglas	Chemical Processing
80	Paradise Creek	Urban Runoff
*81	Milldam Creek	Urban Runoff
81A	Milldam Creek	Urban Runoff
82	Portside	Marina & Dock Area
83	Blows Creek	Military
*84	Lake Kingman	Chemical Processing
85	Craney Is. Coast Guard	Military
86	Tidewater Yacht Agency	Marina & Dock Area
*87	Haven Creek	Urban Runoff

TABLE 2 (continued)

LAND USE ACTIVITY SITES

FOR

PHASE I AND PHASE II SAMPLING

Site #	Site Name	Land Use Activity Category
88	Lilly Creek	Urban Runoff
89	Sterns Creek	Urban Runoff
90	Storm Drain (W. Branch)	Urban Runoff
91	Waterside	Marina & Dock Area
92	Indian River	Urban Runoff

NOTE: * Signifies Phase II Site

SOURCE: Old Dominion University, An Evaluation of the Distribution of Toxicants/Mutagens in the Elizabeth River, Virginia in Relation to Land Use Activities, 1988.

ENDNOTES

[1]Hampton Roads Water Quality Agency, Hampton Roads Water Quality Management Plan, (Virginia Beach, Virginia: HRWQA, 1978), p. 365.

[2]Virginia Department of Waste Management, Virginia Hazardous Waste Notifiers (Richmond, Virginia: DWM, 1989).

[3]Southeastern Virginia Planning District Commission, Hazardous Waste in Southeastern Virginia (Norfolk, Virginia: SVPDC, 1986), p. 47.

[4]Southeastern Virginia Planning District Commission, Comprehensive Elizabeth River Water Quality Management Plan: Institutional Analysis and Land Use/Nonpoint Source Analysis (Norfolk, Virginia: SVPDC, 1986), p. 59.

[5]Superfund Amendments and Reauthorization Act of 1986, Title III, Public Law 99-499.

[6]U.S. Environmental Protection Agency, Environmental Monitoring Systems Laboratory, Inventory of Potential Hazardous Waste Sites Elizabeth River Area, Virginia (Philadelphia, Pennsylvania: EPA, 1987).

[7]NUS Corporation, Field Investigation Team Activities at Uncontrolled Hazardous Substances Facilities - Zone I: Special Project Report - Phase I for the Elizabeth River Study (Philadelphia, Pennsylvania: EPA, 1988).

[8]U.S Department of Defense, Water Quality Assessment of DOD Installations/Facilities in the Chesapeake Bay Region: Phase III Report (Arlington, Virginia: DOD, 1987), pp. 40-41.

[9]Applied Marine Research Laboratory, Old Dominion University, An Evaluation of the Distribution of Toxicants/Mutagens in the Elizabeth River, Virginia in Relation to land Use Activities (Richmond, Virginia: SWCB, 1988), pp. v-xiv.

[10]Ibid, pp. xvi-xix.

APPENDIX H

WATER DEPENDENT FACILITIES

Over the past decade, several studies of coastal resources and water quality management issues in Southeastern Virginia have been completed. All have dealt, at least peripherally, with the question of water-dependent facilities. Water-dependent facilities are generally considered to be those that require a waterfront location. They include recreation facilities such as boat ramps, marinas and fishing areas, and industrial facilities, such as piers, sewage treatment plants, shipyards and seafood processing facilities. Past studies have indicated the need for giving special consideration to the planning and management of such facilities.

VIRGINIA COASTAL RESOURCES MANAGEMENT PROGRAM

Virginia's Coastal Resources Management Program, as does the CRM Program of other states, affords special consideration to some classes of water-dependent facilities. These include energy facilities and shorefront access, primarily for recreation. Insofar as shorefront access is concerned, the VCRMP incorporates specific policies for planning and providing additional areas for public access to the Commonwealth's shoreline. These policies rely on the implementation of the Virginia Outdoors Plan. They include the use of existing publicly owned shoreline areas for public access and the use of state and federal funds for acquisition of new shoreline recreation areas.[1]

Energy facilities are also addressed in the VCRMP. Specific facilities considered include:

- Electric generating facilities;
- Petroleum processing and refining facilities;
- Onshore support facilities for Outer Continental Shelf oil and gas exploration; and,
- Coal exporting piers.

The energy facility planning process relies on maintenance of a comprehensive inventory of coastal energy facilities and the establishment of a site assessment process to evaluate, at an early stage of the siting process, the impacts of proposed facilities. Management of coastal energy facilities requires state participation in the state and federal environmental impact statement processes and the implementation of a variety of state regulatory programs.[2]

To facilitate planning and management efforts in particular areas of the Virginia coastal zone, the VCRMP also includes an element entitled, "Geographic Areas of Particular Concern" (GAPC). Most of the GAPCs that are described in detail in the VCRMP document are natural resource areas. These areas are also generally subject to specific state regulatory programs. Distinctive in the list of GAPCs is the

"Waterfront Development GAPC". This program element affords local governments the opportunity to designate and develop a specific plan and management program for a Waterfront Development GAPC. The VCRMP indicates that priority uses in Waterfront Development GAPCs include:

- water access dependent facilities; and,
- activities that are significantly enhanced by a waterfront location and complementary to other existing and/or planned activities in a given waterfront area.

These activities could include port facilities, shipbuilding and repair, Naval activities, public access to the waterfront, water-related recreation and residential and commercial activities that benefit aesthetically and economically from waterfront locations.[3]

STATE AND FEDERAL PROGRAMS

Water-dependent facilities and activities are given special treatment in the Virginia CRMP, in part, because the federal Coastal Zone Management Act requires them to be specifically addressed. However, other state and federal regulatory programs also require special consideration of the water-dependency of activities in the permitting process. Both the federal Section 404 Program and the Virginia Wetlands Act require that the water-dependent nature of an activity be considered in deciding whether, or not, a permit should be granted. Similar determinations must be made in the Virginia Subaqueous Lands and Sand Dunes Programs. Guidance documents developed through the Chesapeake Bay Program and in response to the 1987 Chesapeake Bay Agreement afford special consideration to public recreational access to the waterfront. For example, during 1988, the signatory states developed the Bay and River Public Access Guide.[4] Each of the states is presently preparing a plan to provide additional public access to the Bay and its tributaries. The draft Criteria for the Virginia Chesapeake Bay Preservation Act also require special attention in the local planning process for water-dependent activities. (Those criteria will be discussed further in an ensuing section.)

LOCAL AND REGIONAL PROGRAMS

Several local and regional studies of water-dependent activities and waterfront access in Southeastern Virginia have been conducted in the last several years. Other studies, while ostensibly conducted for other purposes, have also addressed this question. Local efforts have focussed on provision of:

- Public access to beachfront areas;
- Additional boat ramp and marina facilities;

- Fishing areas and access; and

- Visual and passive recreation access in urban redevelopment.

Local efforts have also attempted to ensure protection of the quality of waterfront recreation and residential and commercial development through beach nourishment and other shoreline protection measures.

Regional programs have served to support local efforts. Of particular significance to the Elizabeth River are the following:

- Regional Energy Impact Analysis. This study inventoried energy facilities throughout the coastal zone of Southeastern Virginia. Most of these facilities are located in the Elizabeth River Basin. It also identified potential economic and environmental impacts associated with the region's energy facilities.

- Hampton Roads Water Quality Management Plan. This study documented the presence and water quality impacts of a variety of waterfront industries and wastewater treatment plants with discharges to the River.

- Comprehensive Elizabeth River Water Quality Management Plan: Preliminary Management Recommendations. This study updated the identification and impact evaluation of waterfront industries and wastewater treatment plants with discharges to the River. It addressed, in a preliminary fashion, the compatibility between various waterfront land uses and river use activities. It also recommended that additional public access, both physical and visual, be provided to the River.

- The Waters of Southeastern Virginia. This study inventoried existing recreational access to the River. Planned access improvements were also identified. Recommendations for providing additional access were made.

Many of the recommendations of the foregoing studies have been or are being implemented. Others are being evaluated in further detail at the local and state level.

CHESAPEAKE BAY PRESERVATION ACT

To date, the most comprehensive treatment of the question of water-dependency in planning and managing land use activities has been the Chesapeake Bay Preservation Act. While the Act itself does not specifically mention water-dependency, it establishes the framework for consideration of all activities that

either adversely impact on water quality or which would benefit from improved water quality. This framework has been used by the staff of the Chesapeake Bay Local Assistance Department in developing draft Criteria to implement the Act. In the regulatory decision-making process, local governments are to consider water-dependency among other factors. The draft Criteria require that local governments prepare or revise their comprehensive plans to include all aspects of the Criteria. To be accomplished in the second year (after adoption of the Criteria) program, the revised local comprehensive plans are to address water-dependent facilities. For the purposes of the Regulations, a water-dependent facility is defined as:

> *"a development of land that cannot exist outside of the Resource Protection Area and must be located on the shoreline by reason of the intrinsic nature of its operation. These facilities include, but are not limited to (i) ports; (ii) the intake and outfall structures of power plants, water treatment plants, sewage treatment plants and storm sewers; (iii) marinas and other boat docking structures; (iv) beaches and other public water-oriented recreation areas, and (v) fisheries or other marine resources facilities."*[5]

Specific requirements for local government planning in the proposed Regulations include:

> *"(1) Local governments should include in their comprehensive plans a plan for water-dependent facilities. As a minimum, local governments should consider the following in the planning process:*
>
> *(a) Impact of water-dependent uses on water quality;*
>
> *(b) Existing wetlands, submerged aquatic plant beds, shellfish beds, anadromous fish spawning grounds, and other important habitat dependent on water quality;*
>
> *(c) Extent and effects of any dredging required, including placement of dredged material;*
>
> *(d) Compatibility of current land uses with water quality protection goals.*
>
> *(2) Local governments should prepare an analysis of the capacity of existing water-dependent facilities and future demands. This analysis should address marinas, boat ramps, public docks, shoreline fishing areas, and other public access to the waterfront or beach. Areas currently zoned for water-dependent facilities should also be evaluated.*

(3) Local governments should identify areas suitable for water-dependent facilities with respect to other comprehensive plan policies and in accordance with performance criteria in Part IV."6

While this is only one component of the required planning necessary to implement the Chesapeake Bay Preservation Act, it is obvious that local governments must consider water-dependency in their land use plans and regulations in an explicit fashion.

WATER-DEPENDENT FACILITIES

Through its various studies, the SVPDC has compiled a preliminary inventory of water-dependent facilities in the Elizabeth River Basin. It has also addressed all or parts of the required CBPA water-dependent facilities planning element. The remainder of this section documents that preliminary inventory and discusses, based on the regional studies, other aspects of the required planning program that require additional study.

To satisfy the Criteria, it appears that three facility and site inventories would need to be developed. They are:

- Inventory of recreation facilities and public access.
- Inventory of existing waterfront and water-dependent land uses.
- Inventory of sites which are potentially suitable for water-dependent land uses.

Through the ongoing environmental planning activities and related studies conducted by the SVPDC, preliminary inventories of each these factors have been completed for the Elizabeth River Basin.

Inventory of Recreation Facilities

Figure 1 summarizes existing and currently proposed recreational access facilities in the Elizabeth River Basin. These facilities are depicted on Figure 2. This summary of recreation access to the River is derived from The Waters of Southeastern Virginia.

The ability of the region's waterfront recreation areas and access points to meet regional recreation needs was analyzed in The Waters of Southeastern Virginia. Specific water-oriented recreation activities examined included: power boating, water skiing, sailing, fishing, canoeing and beach swimming/sunbathing. Conclusions, which are applicable to the Elizabeth River, included:

- Boat ramps providing access to tidal waters often experience overcrowding, especially during the warmer months.

- Marinas are generally filled to capacity during the summer months. Many of them have lengthy waiting lists.

- Canoeable waterways generally have a sufficient number of put-in/take-out points.

- Most of the region's water bodies are deficient in shore fishing opportunities. If water quality in the Elizabeth River continues to improve and fishing opportunities develop, this situation will worsen.

- There is a need along all of the region's waterbodies for additional public access for visual and aesthetic purposes and passive waterfront recreation activities.

The sufficiency of specific facilities was not addressed. However, local recreation studies have addressed many of them, individually. The results of those efforts should be incorporated into the planning effort for water-dependent facilities.

Inventory of Waterfront Industrial Facilities

Based on review of local maps of existing and future land use, USGS 7.5 minute topographic maps and 1985 aerial photography, a preliminary inventory of anticipated waterfront land use was compiled. The future pattern of waterfront land use is depicted on Figure 3. The various waterfront land use activities may or may not be water-dependent. Because of the potential regulatory sensitivity of this issue, no attempt has been made to determine whether individual uses are or are not water-dependent. Determination of the water dependency of an activity should be made during the local regulatory process for proposed waterfront redevelopment or new development.

Considerable waterfront land along the Elizabeth River is presently undeveloped. This is particularly true along the upper Southern Branch of the River. Some undeveloped areas remain along the other Branches and along the lower Main Stem, primarily on the Portsmouth side of the River. It may be appropriate in the local planning effort to designate some portion of this area for future water-dependent activities. The Waterfront Zoning categories of both Norfolk and Portsmouth may be an appropriate vehicle for accomplishing this. Several of the presently undeveloped tracts of land were developed previously. Development in these areas would appear to be governed by the "redevelopment" provisions of the draft CBPA Regulations.

It appears that the water dependency of existing and proposed uses can be categorized to provide a basis for shoreline planning and project review. It is suggested that the following categories be used as the starting point for discussion:

NOT WATER-DEPENDENT - use has no economic reason for locating on the waterfront. Examples might include a movie theater or automobile repair facility.

CULTURALLY WATER-DEPENDENT - use has no present economic reason for locating on the waterfront, but has an historical reason. Examples might include an oil terminal or container storage area.

AESTHETICALLY WATER-DEPENDENT - use has no clear economic reason for locating on the waterfront, but it is significantly enhanced by a waterfront location. Examples could include restaurants or housing.

WATER-DEPENDENT - use has a clear economic reason for locating on the waterfront. Examples could include marinas, Navy and cargo piers, and shipyards.

It should be noted that many water-dependent activities include functions that are not water-dependent. For example, loading and off-loading of products, e.g. oil, coal, and containers, being shipped by water would be water-dependent, but associated storage areas, e.g. tank farms, rail yards and containers storage, may not be water-dependent. Such partially dependent activities would require careful analysis during the local review process.

The draft Regulations require that the capacity and sufficiency of public access facilities be analyzed. Analysis of the sufficiency and capacity of private sector activities is beyond the scope of this study. It is not clear from the draft Regulations that such an analysis will be necessary during the local planning process. However, it can be expected that such an analysis would be required as one element of the market analysis for any proposed facility.

Inventory of Transitional Waterfront Parcels

Figure 4 depicts major transitional parcels of waterfront land located in the Elizabeth River Basin. They were characterized in the CERWQMP: PMR as "Transitional Parcels of Concern". Table 1 lists the identified transitional parcels and their current and expected future uses. (This inventory does not include those non-waterfront parcels identified in the CERWQMP: PMR. Non-waterfront parcels are still of concern in overall nonpoint source and water quality management.) Anticipated future uses are based on local jurisdiction land use plans, known development plans and knowledge of the area.

Including both vacant and currently developed lands, these parcels represent the reservoir of available land that could be developed or redeveloped for water-dependent activities. Ownership of these parcels includes the U.S. Government, local governmental agencies and the private sector. Some of these parcels are currently undergoing development; however, because development plans may not be final, they are included in this inventory. Only those currently developed parcels which are most likely to change use in the near future are included. It is recognized that other currently used parcels may be redeveloped in the future. They will have to be addressed in the local planning process.

Compatibility Analysis

The draft Criteria require that the compatibility of existing land uses with water quality protection goals be analyzed. Appendix B of this study documents an analysis of the compatibility of local goals with River Use/Character Goals and Water Quality Goals. That analysis would appear to be sufficient as a "first cut" at the compatibility analysis required by the Criteria.

Appendix B indicates that there are very few instances of complete compatibility between water quality and river use and development goals for the Elizabeth River. Likewise, there are few instances of total incompatibility or conflict between the goals. Most goals exhibit the potential for conflict or incompatibility. However, it is believed that these potential conflicts can be resolved through the implementation of appropriate management techniques.

The potential for conflict between different uses of waterfront lands, such as residential versus shipbuilding/repair, was identified as an issue early in the process of developing the CERWQMP: PMR. At that time, it was concluded that market forces would be the deciding factor in resolving any potential conflicts. Therefore, no further analysis has been undertaken. It appears that such activities can coexist peacefully as long as local and state regulatory processes are adequate to manage the adverse effects of the more intense use.

Dredging Requirements

One of the river character goals, established for the Elizabeth River in the CERWQMP: PMR, was that it continue to be used as a "commercial and industrial highway". This use will require continued dredging of the River. For example, the Corps of Engineers has recently announced its Intent to Prepare a Supplemental EIS on a project to deepen the Elizabeth River from Lamberts Point (Mile 9) to the Military Highway Bridge (Mile 17.5). To maintain and continue to improve Norfolk Harbor and related channels, additional dredge disposal capacity will be required. Current estimates indicate that the Craney Island Disposal Area will not be sufficient to meet the long-term dredge disposal needs for the Norfolk Harbor and Channels Project. Table 2 summarizes maintenance dredging requirements for this Project. It does not indicate the amount of dredging required during initial construction of an

improved channel. It also does not document the amount of dredged material that must be disposed of from private industrial and recreational dredging projects.

Much of the sediment in the Elizabeth River channels does not meet EPA Criteria for Ocean Disposal, because of toxic contamination. Figure 5 depicts general areas of contaminated sediment in the Elizabeth River. Based on sediment toxicity, it appears that future dredging requirements will continue to require the availability of a contained, non-ocean disposal site as well as one or more approved open ocean disposal areas.

Local governments will need to cooperate with the U.S. Army Corps of Engineers and the Virginia Port Authority to find a suitable site for the long-term disposal of dredge material. Regulation of land uses involving use of hazardous materials or wastes may also be necessary to ensure that additional toxic materials are not introduced into the River. Erosion and sediment controls to reduce the sediment load entering the River will also be particularly important.

Impact Evaluation

The CBPA Criteria require local government plans for water-dependent facilities to include an evaluation of the impacts of those facilities on a variety of aquatic resources. In preparing the Storm Water Management Strategy for the Elizabeth River Basin (Appendix F), the SVPDC and the HRWQA attempted to define the impacts of urban stormwater on aquatic resources, including shellfish beds, spawning grounds and submerged aquatic vegetation. A paucity of data on those resources, especially for the Elizabeth River, was available. It appears that basin localities will need to encourage state and federal resource agencies and scientific institutions to step up their research and data collection efforts. Collection of anecdotal information may assist local governments in defining areas of the River, where these resources may be found.

Insofar as specific water quality impacts are concerned, significant data is available. Additional information on water quality impacts will be developed through the VSWCB Elizabeth River Monitoring Program and through the monitoring activities required of local governments by the EPA Stormwater Permit Program. Further work to analyze the impacts of specific proposals will be required during the local planning process.

FIGURE 1

WATERFRONT RECREATION ACCESS FACILITIES

ELIZABETH RIVER BASIN

	----OWNERSHIP---		----------RECREATION ACTIVITIES----------					
	Public	Private	Boat Ramp	Marina (# of Slips)	Canoe PI/TO	Shoreline Recreation	Fishing	Swimming
Waterside Municipal Marina	X			52				
Elizabeth River Boat Works		C		25				
Tidewater Yacht Marina		C		340				
Freemason Harbor Marina		P		35				
Norfolk Boat Club		P		2				
Old Dominion University Landing		P	1		X		X	
Portsmouth Naval Hospital		P	1		X			
Haven Creek City Landing	X		1		X			
Lafayette City Park	X		1		X	X		
45th Street City Landing	X		1	10	X			
Morgan's Snug Harbor Marina		C		27				
Norfolk Yacht and County Club		P	3	125	X			
Tidewater Boat Club		P		100				
American Legion Post 60		P		22				
Pritchard Marine Railway		C		24				
Portsmouth Yacht Club		P	1	20	X			
Portsmouth City Park	X		4		X	X	X	
Lee's Yacht Harbor		C		95				
Virginia Boat and Yacht Service		C		56				
Sandie Point Condominiums		P		20				
Elizabeth Landing Condominiums		P		6				
Cypress Cove Association		P		20				
Great Bridge Locks Park	X		2		X	X	X	
Causey Street City Landing (Grandy Park Boat Ramp)	X		1		X			
Elizabeth River Yacht and Dry Storage		C	2	150	X			
Willoughby Bay Marina		C	4	55 300 - Dry				X

FIGURE 1 (Continued)

WATERFRONT RECREATION ACCESS FACILITIES

ELIZABETH RIVER BASIN

	----OWNERSHIP---		----------RECREATION ACTIVITIES----------					
	Public	Private	Boat Ramp	Marina (# of Slips)	Canoe PI/TO	Shoreline Recreation	Fishing	Swimming
Willoughby City Landing	X		2		X			X
Willoughby Harbor Marina		C		298				
Naval Air Station		P	2		X			
Naval Base		P	2	90	X			
Mayflower Road	X				X	X		
Granby Street Bridge	X				X		X	
Hampton Boulevad Bridge	X						X	
Lucille Avenue	X				X			
Villa Circle	X				X			
Norview Avenue Bridge	X				X			
Dock Landing Road Bridge	X				X			
Airline Boulevard Bridge	X				X			
Deep Creek Locks Park	X				X		X	
George Washington Highway Bridge	X				X			
Fireman Street	X				X			
Berkshire Drive	X				X			
Princess Anne Road Bridge	X				X			
Laurel Avenue	X				X			
Riveredge Road	X				X			
West Cove Court	X				X			
Piney Branch Court	X				X			
Willoughby Neighborhood Park	X						X	
Northside Park	X						X	
Mowbray Arch Walkway	X						X	
Hague Park	X						X	
Stone Park	X					X		
The Hermitage Foundation Museum		P				X		

FIGURE 1 (Continued)

WATERFRONT RECREATION ACCESS FACILITIES

ELIZABETH RIVER BASIN

	----OWNERSHIP---		----------RECREATION ACTIVITIES----------					
	Public	Private	Boat Ramp	Marina (# of Slips)	Canoe Pl/TO	Shoreline Recreation	Fishing	Swimming
Larchmont Library	X					X		
Granby Elementary School	X					X		
North Shore Road Park	X					X		
Millbrook Road Park	X					X		
Larchmont Elementary School	X					X		
26th Street Bridge Park	X					X		
Lindenwood Elementary School	X					X		
Barraud Park	X					X		
Lakewood Park	X					X		
Town Point Park	X					X		
Waterside Promenade and Esplanade	X					X		
Berkeley Waterfront Park	X					X		
Grandy Park	X					X		
Poplar Hall Elementary School	X					X		
Broad Creek Pedestrian Bridge	X					X		
Wayside Park	X					X		
Arrowhead Elementary School	X					X		
Carolanne Farms Park	X					X		
Fairfield Forest Park	X					X		
Jordan Bridge Site	X		(P)			X		
West Norfolk Bridge Site	X						X	
Portsmouth Seawall	X					X		
Simonsdale Elementary School	X					X		
Western Branch Park	X					X		
Southwestern Elementary School	X					X		
Willoughby Bay (4th View Street) Recreation Area	(P)			(P)		(P)		

FIGURE 1 (Continued)

WATERFRONT RECREATION ACCESS FACILITIES

ELIZABETH RIVER BASIN

	----OWNERSHIP---		----------RECREATION ACTIVITIES----------					
	Public	Private	Boat Ramp	Marina (# of Slips)	Canoe Pl/TO	Shoreline Recreation	Fishing	Swimming
Lambert's Point Landfill Park	X					(P)		
Freemason Harbor Park	X					(P)		
National Maritime Center	X			(P)		(P)		
Holly Avenue Walkway	X					(P)		
Berkeley Neighborhood Parks	X					(P)		
Craney Island Creek Boak Ramp	X		(P)					
Scotts Creek Waterfront Park	X		(P)			(P)		
Bayview Park	X					(P)		
Paradise Creek Boat Ramp	X		(P)					
Great Bridge Landfill Park	X					(P)		
Steamboat Creek Marina		(P)		(P)				
Scotts Creek Marina		C		162(P)				
Elizabeth Cove Condominiums		P		56(P)				
Canoe Trails - Various Locations	(P)							

NOTES:
X Facility/Activity Available
Ownership Column - Public
C Commercial Ownership
P Private Ownership
(P) Proposed Facility
Fishing areas include only shore or pier fishing.

Source: SVPDC, The Waters of Southeastern Virginia, 1988.

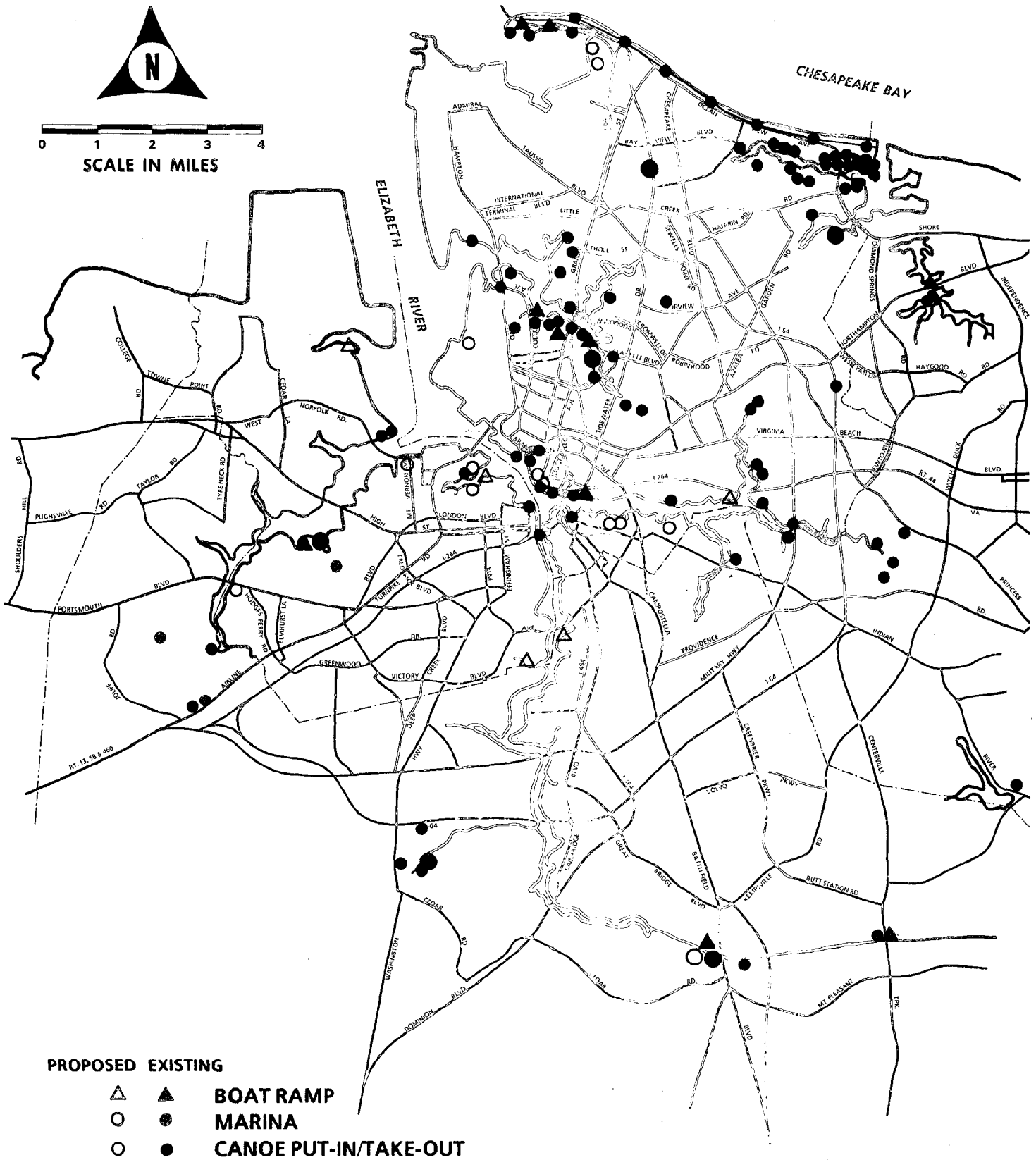
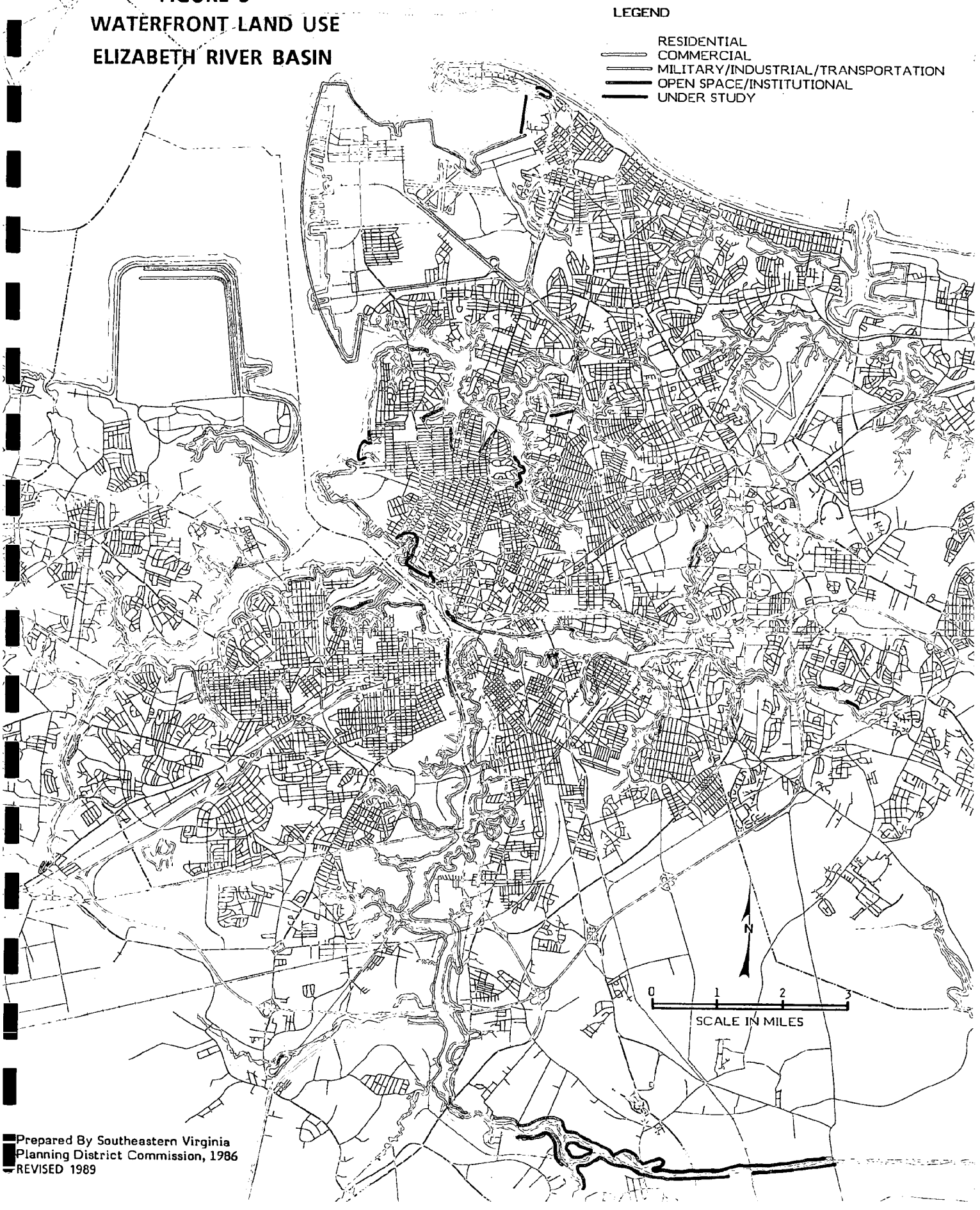


FIGURE 2
WATERFRONT RECREATION ACCESS FACILITIES
ELIZABETH RIVER BASIN

PREPARED BY SVPDC 1989
SOURCE: The Waters of Southeastern Virginia, SVPDC, 1988.

FIGURE 3
WATERFRONT LAND USE
ELIZABETH RIVER BASIN



Prepared By Southeastern Virginia
Planning District Commission, 1986
REVISED 1989

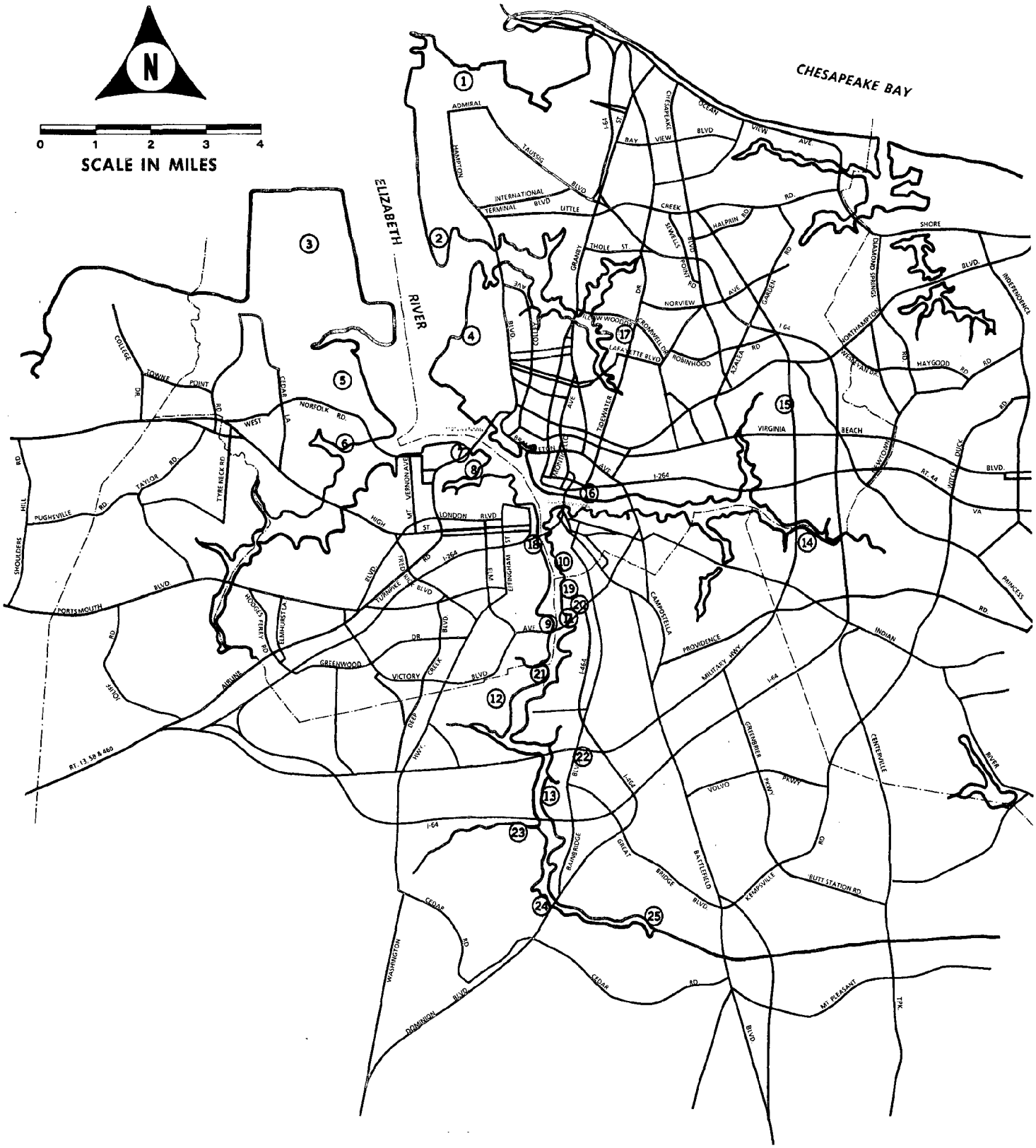


FIGURE 4
TRANSITIONAL WATERFRONT PARCELS
ELIZABETH RIVER BASIN

NOTE: MAP NUMBERS REFER TO TABLE 1

PREPARED BY SVPDC 1989

TABLE 1

TRANSITIONAL WATERFRONT PARCELS

ELIZABETH RIVER BASIN

Map No.	*Name*	*Current Use*	*Future Use*
1	Naval Base	Industrial	Industrial-Use Intensification & Paved Areas
2	Norfolk Int. Terminals	Industrial	Industrial-Use Intensification
3	Craney Island Disposal Area	Dredged Material Disposal	Same, Industry Recreation
4	Lamberts Pt.	Vacant-Closed	Recreation Landfill
5	Cox Site	Vacant	Mixed Use
6	River Pointe	Developing	Mixed Use
7	Pinners Point	STP	Unknown
8	Scotts Creek	Vacant-Mixed	Harbor Services Recreation, Residential
9	Atlantic City	Mixed	Industrial, Commercial
10	St. Helena	Industrial	Industrial-Use Intensification
11	Allied	Industrial	Industrial
12	St. Juliens	Industrial	Industrial-Use Intensification
13	Columbia Yacht	Industrial	Industrial-Use Intensification
14	E. R. Shores	Vacant	Unknown

TABLE 1 (continued)

TRANSITIONAL WATERFRONT PARCELS

ELIZABETH RIVER BASIN

Map No.	*Name*	*Current Use*	*Future Use*
15	Raby Road	Vacant	Unknown
16	Bessie's Place	Commercial Vacant	Unknown
17	Lafayette Shores	Developing	Mixed Density Residential
18	Coast Guard Base	Vacant	Commercial, Mixed Use
19	Gulf Oil	Oil Terminal Closed	Industrial-Use Intensification
20	J.G. Wilson	Industrial	Industrial-Use Intensification
21	Farmer's Export	Vacant	Industrial
22	Smith-Douglas	Industrial	Industrial-Use Intensification
23	Gilmerton	Vacant	Mixed Use-Marina
24	Dominion Blvd.-Bells Mill	Industrial & Vacant	Industrial, Residential, Unknown
25	N. Shore - Intra-coastal Wtwy.	Vacant	Residential, Unknown

Source: Southeastern Virginia Planning District Commission, 1986 and 1989.

TABLE 2

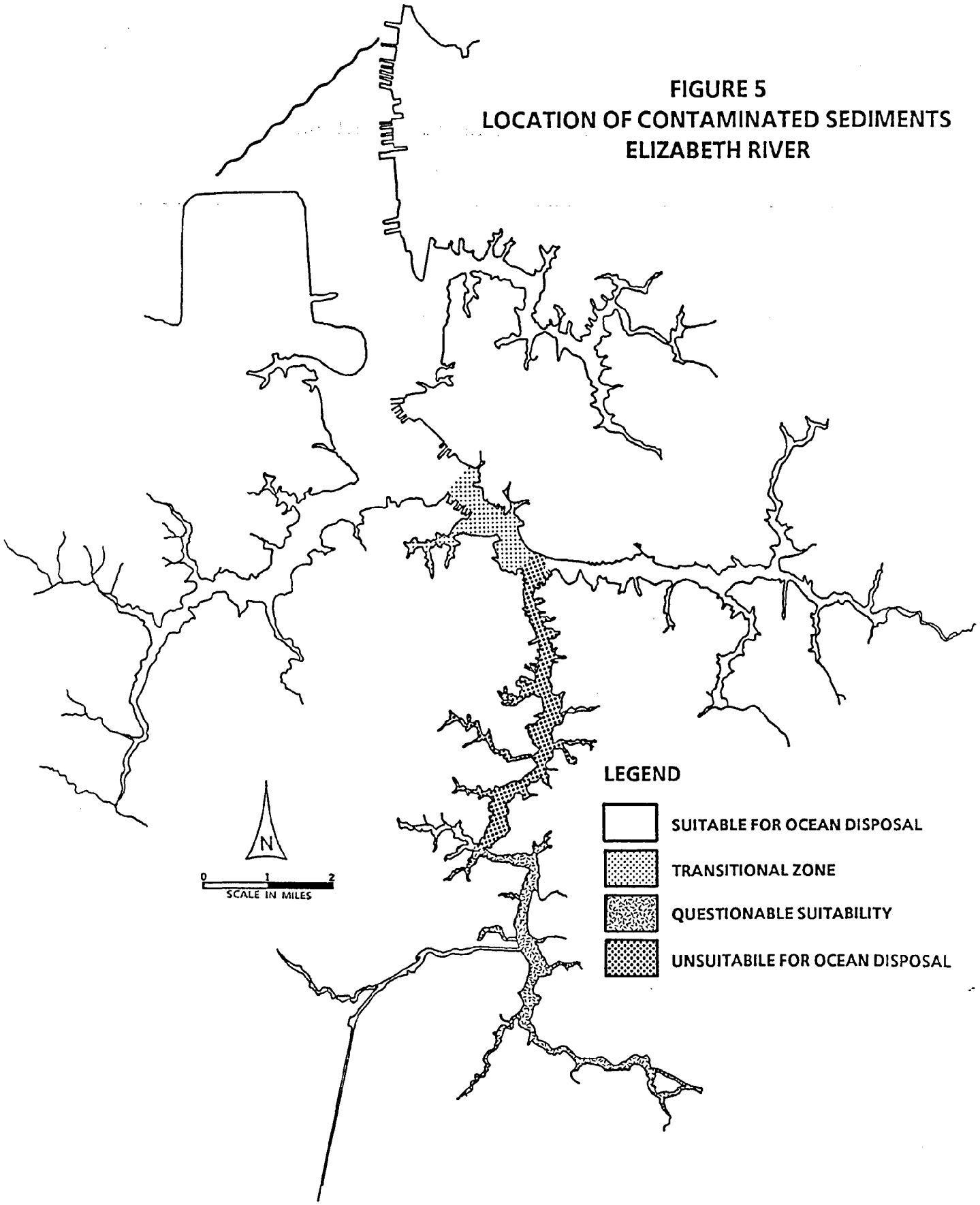
MAINTENANCE DREDGING REQUIREMENTS

HAMPTON ROADS

Authorized Project Feature	*Normal Maintenance Interval (years)*	*Normal Quantityl Maintenance (cu. yds.)*	*Average Annual Removed (cu. yds.)*
Norfolk Harbor 45 & 50' Channel	1-2	1,000,000	1,000,000
Norfolk Harbor 40' Channel	10	500,000	50,000
Southern Branch 35' Channel	5	400,000	80,000
Anchorage Opposite Sewells Point	3	900,000	300,000
Channel to Newport News	5	600,000	120,000
Anchorage Opposite Newport News	5	500,000	100,000
Craney Island Rehandling Basin	2	2,000,000	1,000,000

Source: U. S. Army, Corps of Engineers, Norfolk District, Dredging Maintenance Branch, 1988.

FIGURE 5
LOCATION OF CONTAMINATED SEDIMENTS
ELIZABETH RIVER



PREPARED BY SVPDC 1989
SOURCE: Alden and Butt, 1987, in SWCB, Elizabeth River 205(j) Water Quality Plan-Draft, 1988.

ENDNOTES

[1]Virginia Council on the Environment with U.S. Department of Commerce, National Oceanic and Atmospheric Administration, Commonwealth of Virginia Coastal Resources Management Program and Final Environmental Impact Statement (Washington, D.C.: DOC, 1986), Chapter VI.

[2]Ibid, Chapter VI.

[3]Ibid, Chapter V, pp. 23-25.

[4]Public Access Task Force Committee, Chesapeake Bay and Susquehanna River Public Access Guide (Richmond, Virginia: Commonwealth of Virginia, 1989).

[5]Chesapeake Bay Local Assistance Board, "Chesapeake Bay Preservation Area Designation and Management Regulations," Section 1.4 in 5 Virginia Register of Regulations 1891, April 24, 1989.

[6]Ibid, Section 5.4.C.1.c.

[7]U.S. Army Corps of Engineers, "Intent to Prepare a Draft Supplemental Environmental Impact Statement (DSEIS) for Proposed Elizabeth River and Southern Branch 45-foot and 40-foot Navigation Improvements in the Vicinity of Norfolk Harbor, Hampton Roads, Virginia" at 54 Federal Register 15964, April 20, 1989.

APPENDIX I

INFORMATION SYSTEM AND DATA MANAGEMENT

NEEDS

In 1980, the SVPDC completed an evaluation of the feasibility of developing a Regional Environmental Information System - essentially a geographic information system (GIS) for environmental data. Most systems in use at that time required use of a mainframe computer. The SVPDC evaluation concluded that such a system was not feasible at that time due to:

- Cost, primarily associated with acquisition of hardware and development of function-specific software.
- Off the shelf software, for analytical and graphic functions, did not exist.
- Data resolution for computerized graphic data was not good.
- Staffing requirements for use of such a system would be extensive.

No further activity to develop a regional GIS ensued, although the utility of such a system has seemed obvious during the conduct of several sizable studies.

Over the last decade, geographic information systems have evolved and improved significantly. Much of this improvement has been associated with improvements in hardware, including the development and widespread use of personal computers and related equipment. Increasingly, the need for managing and manipulating extensive natural resource data bases and producing graphic displays of the data and associated analyses has been recognized. It is believed that this recognition has contributed to the development of more sophisticated and affordable software. In that context, it appears appropriate to, again, consider the development of a Regional Environmental GIS for Southeastern Virginia.

STATE AND FEDERAL GIS

GIS development in Virginia is proceeding at a rapid pace. Both state and federal agencies have and are developing and refining extensive natural resource data bases. Common to most of them is the use of a proprietary system - ARC/INFO. It appears that this system will be the framework for most environmental information systems for the foreseeable future.

The U.S. Geological Survey has used a GIS for inventorying and analyzing hazardous waste sites in the Elizabeth River Basin. That GIS effort was described in Appendix G. The system includes an inventory of potential hazardous waste sites developed by the Environmental Protection Agency. This system also includes extensive land resource data, such as soils, bedrock and surficial geology and hydrographic features as well as cultural features, such as transportation facilities. The data base is now being expanded to include aquifer characteristics and groundwater use. It is expected that the GIS will be linked to the USGS Groundwater Model for Southeastern Virginia.

The U.S. Army Corps of Engineers is conducting a Hurricane Evacuation Study for Eastern Virginia, including Hampton Roads. The study requires the definition of areas of potential flooding associated with hurricanes of various strengths. The GIS, developed by the USGS for the Elizabeth River Basin, has been used by the COE to define these flood areas for portions of the Elizabeth River. That effort is being viewed as a model for use in other portions of the study area.

The Virginia Council on the Environment is developing a GIS for use in the Virginia Rivers Inventory. The Rivers Inventory data base will include natural resource and cultural features data for each river basin in the state. Initial focus of the effort is expected to be Tidewater Virginia, including the Chesapeake Bay Basin. The VCOE activity will establish a clearinghouse for data, compiled by a number of other agencies, including USGS, the State Water Control Board, Virginia Institute of Marine Science and local governments.

As discussed in several preceding sections of this report, the 1988 Virginia General Assembly enacted the Chesapeake Bay Preservation Act. Delineation of Chesapeake Bay Preservation Areas and long-term management of those areas as well as protection of water quality in the Bay and its tributaries will require an extensive analytical and data management effort. The Chesapeake Bay Local Assistance Department has indicated its intent to rely on the Virginia Rivers Inventory as a data base analysis and management system for this program. A similar program, the Land Resources Information System, has been adopted by the State of North Carolina for use in the Albemarle-Pamlico Estuarine Study.

Several recent studies by and for state agencies have documented the need for improved capability to manage and relate natural resource and cultural features data. In its draft Elizabeth River Water Quality Plan, the SWCB has indicated its intent, in plan implementation, to use the USGS system to pinpoint nonpoint sources of pollution and to assist it in determining the relative contributions of point and nonpoint sources to water quality problems in the Elizabeth River. A study conducted by Old Dominion University for use by the SWCB in preparing its plan indicated that there were problems in relating land use activities to the storm drainage system and nonpoint source water quality problems in the River.

LOCAL GIS EFFORTS

Several local governments in Southeastern Virginia have taken steps to develop geographic information systems, primarily related to provision of public facilities and the management of land use. The City of Virginia Beach has adopted the use of Intergraph, a proprietary system, for computerizing land records. This system is also used for mapping the City's water, sewer and drainage systems. To facilitate use of the extensive state and federal environmental information data bases, the City is now developing the capability of interfacing its existing system with ARC/INFO. The other communities in the Elizabeth River Basin are also exploring this linkage in

order to facilitate the use of those state and federal data bases. The region's remaining localities are evaluating and can be expected to develop similar systems to facilitate compliance with the CBPA. Some area localities are also evaluating adoption of similar systems to assist them in complying with the requirements of the Superfund Amendments and Reauthorization Act (SARA) of 1986.

The region's six local governments that are affected by the Chesapeake Bay Preservation Act are exploring possible development of a Regional GIS to assist in complying with the requirements of the CBPA Criteria.

SVPDC STUDIES

As indicated earlier, a 1980 SVPDC study concluded that a regional GIS was not feasible at that time. Since that time, the SVPDC has completed a number of environmental studies, which could have benefitted from use of a GIS. They include:

- Comprehensive Elizabeth River Water Quality Management Plan: Preliminary Management Recommendations, as well as this followup study.

- The Waters of Southeastern Virginia.

- Various hazardous waste and hazardous materials studies. In particular, a GIS could have been used to assist the localities to comply with the requirements of SARA Title III with respect to delineation of evacuation routes and areas.

- Regional Stormwater Management Strategy for Southeastern Virginia which is in progress. The inventory of storm drainage outfalls and their relationship to various land uses and critical aquatic resources would have been improved. Its development also would have been easier. For future activities, a GIS including this information could assist the localities in complying with the EPA Stormwater Permitting Program.

- Technical assistance to localities and developers in locating potential hazardous waste sites.

- Regional Recreation Facilities Inventory. Use of this computerized data base could be improved through application of GIS technology for analysis and mapping.

Several of these studies were faced with the problem of lack of comparability of available data. Much data, particularly on natural resources, was available from researchers and state regulators only in hard copy and frequently only in "one of a kind" working form. Also, data, which was available, was frequently not

aggregated in the form necessary for the study. For example, land use data was aggregated by Transportation Zone, but not by Drainage Basin. As a result, extensive effort was required to develop acreage by various land use categories for each drainage basin. The relationship between land use and aquatic resources, where data was available, was not obvious. Finally, our ability to track land use change and resource modifications is compromised by the current manual information system. Development of current land use and resource maps would have been facilitated by the use of a GIS.

GIS NEED

The SVPDC, in discussions with representatives of several of the jurisdictions, has concluded that a Regional Geographic Information System is necessary to enhance the region's ability to plan for and manage development and environmental protection in Southeastern Virginia. While the SVPDC does not manage development, it does undertake technical studies and provide advice to local governments in their efforts to do so. Regional capability in this area would facilitate efforts by the region's local governments to manage development in a cost-effective and environmentally sound manner. In the context of the current study, the most immediate need is directly related to the Elizabeth River Basin, because:

- The Basin is multi-jurisdictional. As a result data management needs are multi-jurisdictional. While individual local government systems may be sufficient for basins contained solely within one jurisdiction, coordination and overlapping needs call for an integrated system for the Elizabeth River Basin.

- The Basin is covered by the Chesapeake Bay Preservation Act. Basin jurisdictions are faced with immediate needs for delineating CB Preservation Areas and establishing a system for monitoring the success of management efforts.

Once established for the Elizabeth River Basin, a Regional GIS could be readily expanded to cover additional basins or the region in its entirety. As indicated earlier, several of the region's local governments are actively exploring the possibility of developing a Regional GIS to assist them in complying with the CBPA requirements. Obviously, the Elizabeth River Basin constitutes a large portion of the affected area.

Specific uses for a Regional GIS for the Elizabeth River and for Southeastern Virginia include:

- Preparation of improved base maps and special studies maps in a timely fashion.

- Aggregate land use data by a variety of geographic areas, including drainage basin, jurisdiction, census tract, transportation zone, utility service area, and so forth.

- Improve ability to integrate and analyze land use and natural resource information, including data from USGS, SWCB, EPA, Army COE, Virginia Council on the Environment Rivers Inventory, VIMS and the North Carolina Land Resource Information System.

- Through the provision of maps, data, and special studies, assist local governments in complying with the mandates of a variety of environmental planning and management programs, including:

  - Chesapeake Bay Preservation Act - Delineation of Preservation Areas, evaluation of alternative management schemes, and evaluation of development impacts.

  - EPA Stormwater Permitting Program.

  - SARA Title III emergency planning and response as well as the community right-to-know portion of the program.

  - General land use compatibility analyses.

  - Annotation of environmental restrictions on land parcel identification maps and records.

  - Monitoring the success of environmental management programs.

- Enhance SVPDC ability to assist local governments and the private sector, including

  - identification of potential hazardous waste sites through the private sector environmental audit programs

  - facility siting studies, especially those that are multi-jurisdictional in nature. Such efforts include transportation facilities and utilities.

- Facilitate SVPDC efforts to obtain state and federal natural resource data. This data is routinely needed for special studies and for fulfilling information requests from local governments and the private sector. Much of this data is presently included in or being entered into an ARC/INFO system.

- Improve SVPDC ability to prepare, in a timely fashion, customized maps of land use and natural resource data at varying scales for specialized studies in response to requests from local governments.

- Enable SVPDC to assist local governments in addressing a need for data and mapping, identified through the Chesapeake Bay Preservation Act program as a high priority.

While the above listing of GIS uses is generic in nature and applicable to Southeastern Virginia as a whole, the most immediate need relates to the continuing planning and management requirements of the Elizabeth River Basin. It must be recognized that system development will be a lengthy process and the above-noted uses will not be achieved in their entirety for some time.

GIS ALTERNATIVES

GIS software has been developed for a variety of hardware configurations - mainframe, minicomputer, workstation and personal computer. At the present time, SVPDC does not have routine access to a mainframe or minicomputer computer or workstation. Both of these hardware alternatives are very expensive - in excess of $100,000 at minimum. Mainframe and minicomputer information systems are being developed and implemented by state and federal agencies. In some cases, these systems can be accessed through a personal computer using the same software.

A wide variety of software options is available for each of the hardware options. However, relatively few have been developed fully for use on personal computers. Of these, only one that has been identified to date has versions available for both mainframe and personal computers. That system is ARC/INFO. Most of the state and federal resource agencies that are developing systems with applicability to Southeastern Virginia are using that system. These mainframe systems can be accessed with a personal computer using pcARC/INFO. In addition, the City of Virginia Beach is developing the capability to interface its existing workstation system with ARC/INFO. For that reason, it appears that pcARC/INFO should be the GIS of choice for SVPDC.

The most recent issue of the Journal of the American Planning Association contained a review of four GIS software packages that had been developed for the IBM personal computer and compatibles. They included Atlas*Graphics, LandTrak, MapInfo and pcARC/INFO. The review concluded that, despite some shortcomings, these systems are quite powerful and well suited to specific planning applications and for some types of spatial analysis. With respect to pcARC/INFO, the review noted a variety of advantages and disadvantages. Advantages included:

- It has a strong topologic structure - features "know" where they are in relation to all other features. This permits the user to build analytical models and to make a range of locational queries.

- It can be used to overlay multiple map coverages and map coverage data. This capability is important for notification, market area analysis and impact assessment.

- It allows the user to specify data-value polygons and to use those polygons to assign data values of characteristics to a base map. This capability can be used in assigning zoning codes to parcels or in identifying parcels subject to a variety of environmental or regulatory constraints.

- It has a powerful digitizing capability permitting precise cartographic accuracy.

- The database portion permits users to link data from a variety of databases, such as a parcel file and a separate natural resource file.[1]

Key disadvantages include:

- It does not handle point data very well, because it is a line-based system.

- The database manager is fairly cumbersome.

- Display functions are somewhat cumbersome to use.

- Error-checking routines are of uneven quality.

- It is a relatively slow system on all but the fastest systems.[2]

RECOMMENDED REGIONAL GIS FOR SOUTHEASTERN VIRGINIA

The foregoing sections of this report have described the evolution of geographic information systems as an affordable and very useful tool in environmental planning and management. They have pointed out that most state and federal systems have settled on the use of ARC/INFO. A number of potential uses for such a system in Southeastern Virginia, focussing initially on the Elizabeth River Basin, have been described. Finally, advantages and disadvantages of the pcARC/INFO system have been noted.

At the present time, the SVPDC has developed extensive computing capability. All staff members have full-time use of an IBM-compatible Personal Computer. These machines are used for Word Processing, Spread Sheet Analysis, Statistical Analysis, Data Base Management and Transportation Analysis and Modelling. All SVPDC reports are produced using a desk-top publishing system. The SVPDC has recently, through the Virginia Coastal Resources Management Program, purchased a

Personal Computer configured to support the use of pcARC/INFO. According to the analysis reviewed above, this machine is capable of overcoming the disadvantage of the slow speed of this system. The SVPDC also has a Pen Plotter which supports pcARC/INFO.

To implement a Regional GIS for Southeastern Virginia, the SVPDC needs the following equipment:

- Digitizer
- Mouse
- Modem, for direct connection to host computers using ARC/INFO, at USGS, VCOE, VIMS and the State of North Carolina.
- Tape drive backup for storing extensive ARC/INFO files.

In addition to the aforementioned equipment, the SVPDC should purchase the pc version of ARC/INFO to include:

- pcARC/INFO Starter Kit
- pcGrid Conversion
- pcOverlay
- pcARCPLOT
- pcARCEDIT
- pcNETWORK
- pcINFO.

Existing staff would be sufficient to manage the Regional GIS. However, it would be necessary to add staff capability to:

- Enter ARC/INFO data files, obtained from VCOE, USGS, VIMS, North Carolina and local governments.
- Digitize newly obtained or created data.

Implementation of a Regional GIS for Southeastern Virginia, using the ARC/INFO system to be compatible with evolving state, federal and local information systems is important to the long- term efforts to manage environmental quality in

the Elizabeth River Basin. It is the logical next step in the development and evolution of environmental planning and management capability at SVPDC.

SYSTEM COSTS

Acquisition of a Regional GIS for Southeastern Virginia is estimated to have the following first year (including acquisition of hardware and software) cost:

- Personnel - $35,000.00
- Equipment - 4,254.00
- Software - 13,025.00 (including training package)
- TOTAL $52,279.00

Ongoing annual costs are estimated to be $30-35,000.00 for personnel and maintenance/support. Personnel costs assumed in this analysis involve one part-time planner and one technician/planner.

ENDNOTES

[1]Johnathon Levin andJohn D. Landis, "Geographic Information Systems for Local Planning," in Journal of the American Planning Association, Volume 55, No. 2 (Chicago, Illinois: APA, 1989), p. 217.

[2]Ibid, pp. 217-218.

APPENDIX J

SUMMARY OF PROPOSED

U.S. ENVIRONMENTAL PROTECTION AGENCY

STORMWATER DISCHARGE PERMIT

REGULATIONS

EXECUTIVE SUMMARY

The 1987 Water Quality Act (WQA) mandates the promulgation of NPDES stormwater permitting regulations for discharges associated with industrial activities; discharges from large municipal separate storm sewer systems serving a population of 250,000 or more; and discharges from medium municipal separate storm sewer systems serving a population between 100,000 and 250,000. In response to this mandate, the EPA published proposed regulations in the December 7, 1988 Federal Register (53 FR 49416). Comments on these regulations will be accepted by the EPA until March 7, 1989.

This report summarizes the proposed regulations as they pertain to discharges from municipal storm sewer systems and discusses the implications that these regulations have for the localities of Southeastern Virginia. The proposed permitting regulations for discharges associated with industrial activity are not addressed in this report, except in the case where a municipal system receives such discharges.

PERMITTING DEADLINES

The 1987 WQA establishes deadlines for developing and complying with permit application requirements for large and medium municipal systems. The EPA intends to apply identical permitting regulations to both large and medium dischargers. As currently proposed, the only difference between the two permitting programs would be the compliance deadlines. The WQA requires that EPA promulgate final permitting regulations for large municipal systems by February 4, 1989. The EPA was unable to meet this deadline and expects that the final regulations will not be published until early 1990. The WQA mandates that permitting regulations for medium stormwater systems be promulgated by February 4, 1991. For both large and medium municipal systems, permit applications must be submitted within one year of promulgation, permits must be issued or denied within two years of promulgation, and permit compliance must be attained within three years of permit issuance.

PROPOSED PERMIT APPLICATION REQUIREMENTS

The EPA proposes a two-part application process for both large and medium municipal storm sewer systems which would be structured to address four key issues. These include (1) the viability of local institutional mechanisms for controlling pollutants in stormwater discharges, (2) an identification of the sources of pollutants in stormwater discharges, (3) a characterization of stormwater discharges, and (4) the development of stormwater management programs. The proposed regulations contain specific information requirements for each of these issues.

LOCAL IMPLICATIONS OF PROPOSED REGULATIONS

Virginia Beach, Norfolk, Chesapeake and Portsmouth are the only localities in Southeastern Virginia large enough to be subject to the proposed permitting regulations. The other localities may be subject to the regulations for smaller municipal systems that, according to the WQA, must be promulgated by the EPA by October 1, 1992.

The EPA estimates that, to prepare a permit application, it will cost $131,200 for the average large municipal storm sewer system, and $83,600 for the average medium storm sewer system. Federal funding assistance for applying for and complying with permits is not provided for in the 1987 WQA. Several options for reducing the costs associated with the permit application process are discussed in this report. The EPA is considering the selection of a Southeastern Virginia locality for participation in a pilot program that would provide contractor support to assist localities in preparing permit applications. The EPA is also trying to develop a cooperative funding program through which the USGS would aid municipalities in the collection of the representative data required in the discharge characterization component of the permit application. Finally, a regional, cooperative stormwater management program could be established. Such a program could provide assistance in the preparation of permit applications, develop a program through which localities can share the cost of discharge sampling and analysis, implement a regional representative sampling and monitoring program, provide a forum through which information can be exchanged, and coordinate control strategies in drainage basins located in more than one locality.

The 1987 Water Quality Act (WQA) directs the EPA to promulgate NPDES permit application regulations for stormwater discharges in accordance with specific guidelines. The purpose of this report is threefold: (1) to provide an overview of the WQA stormwater permitting guidelines for municipal separate storm sewer system, (2) to summarize the regulations that EPA has proposed in response to these guidelines, and (3) to analyze the implications that the proposed regulations have for the localities of Southeastern Virginia.

1987 WQA STORMWATER DISCHARGE PERMITTING GUIDELINES

Section 402(p)(1) of the 1987 WQA states that, prior to October 1, 1992, no permits will be required for discharges composed entirely of stormwater, except in the following cases:

1. Stormwater discharges already permitted prior to enactment of the 1987 WQA.

2. Stormwater associated with industrial activity.

3. A discharge from a municipal storm sewer serving a population of 250,000 or more.

4. A discharge from a municipal storm sewer serving a population of 100,000 to 250,000.

5. A discharge which, based on a determination by the EPA administrator or the state, contributes to a violation of a water quality standard or is a significant contributor of pollutants to the waters of the United States.

By October 1, 1992, the EPA is required to issue regulations which will (1) designate stormwater discharges, other than those listed above, which are to be regulated to protect water quality, and (2) establish a comprehensive program to regulate such discharges. These regulations will be based on the findings of two studies to be conducted by the EPA. The first study, which was to be submitted to Congress by October 1, 1988, is required to identify which additional categories of stormwater discharges will be subject to permitting after October 1, 1992, and to identify the nature and extent of pollutants in such discharges. The EPA did not meet the mandated deadline for completion of this study. As of this writing, the EPA anticipates that the final report will be submitted to Congress in the summer of 1989. The second study, which is to be presented to Congress no later than October 1, 1989, will establish procedures and methods to control these stormwater discharges to the extent necessary to mitigate impacts on water quality.

The 1987 WQA also contains the following general provisions for permitting municipal stormwater discharges:

- Permits may be issued on a system or jurisdiction-wide basis.
- Permits shall include a requirement to effectively prohibit non-stormwater discharges into the storm sewers.
- Permits shall require controls to reduce the discharge of pollutants to the maximum extent practicable, including management practices, control techniques and system design and engineering methods, and such other provisions as the EPA Administrator or the State determines appropriate for the control of such pollutants.

1987 WQA deadlines for establishing and complying with the permit application requirements are as follows:

1. For industrial and municipal dischargers serving populations over 250,000:
   - The EPA shall promulgate regulations setting forth permit application requirements by February 4, 1989.
   - Applications must be submitted by February 4, 1990.
   - Permits must be issued or denied by February 4, 1991.
   - Permit compliance must be attained within three years of permit issuance.

2 For municipal dischargers serving populations between 100,000 and 250,000:
   - The EPA shall promulgate regulations setting forth permit application requirements by February 4, 1991.
   - Applications must be submitted by February 4, 1992.
   - Permits must be issued or denied by February 4, 1993.
   - Permit compliance must be attained within three years of permit issuance.

REGULATIONS PROPOSED BY THE EPA TO IMPLEMENT THE STORMWATER PERMITTING PROVISIONS OF THE 1987 WQA

This section discusses EPA's proposed permit application requirements for medium and large municipal separate storm sewer systems. These proposed regulations are found in the December 7, 1988 Federal Register. This section does not address the proposed permitting requirements for discharges associated with industrial activity, which are found in the same Federal Register notice, except in the case where a municipal system receives such discharges.

It should be emphasized that the regulations summarized below are proposals on which the EPA is seeking comment. Given the EPA's history in trying to develop final stormwater permitting regulations under the 1972 Clean Water Act, it is likely that the proposals discussed in this report will undergo some change before the final regulations are promulgated. However, the strict promulgation deadlines established by the WQA for large municipal systems do not allow for a major revision of the proposed regulations. History would indicate that legal challenges will be brought against the EPA after the final rules are promulgated. This could eventually lead to a remand and further revision of the regulations.

PROPOSED STRATEGY FOR IMPLEMENTING THE PERMIT PROGRAM

The EPA's proposed permit application procedures for large and medium municipal separate storm sewer systems are structured to lead to the development of site-specific stormwater management programs which would consist of locally appropriate pollution control measures. Permit conditions based on information received in the permit applications would be developed to guide the implementation of the site-specific programs. EPA's proposed strategy is based on the recognition that municipal separate storm sewer systems in different parts of the country vary with respect to the nature of their discharges as well as to the impacts those discharges have on the quality of receiving waters. Therefore, the EPA felt that it was impractical to develop one standard set of control measures for all pollutants discharged from all municipal systems.

DEFINITION OF LARGE AND MEDIUM MUNICIPAL SEPARATE STORM SEWER SYSTEMS

The EPA proposes to define a "municipal separate storm sewer" as "any conveyance or system of conveyances that is owned or operated by a State or local government entity and is used for collecting and conveying storm water which is not part of a publicly owned treatment works".

The 1987 WQA mandates that large municipal separate storm sewer systems (those serving populations greater than 250,000) and medium municipal separate storm sewer systems (those serving populations between 100,000 and 250,000) be covered by NPDES permits. The WQA does not, however, provide a geographic

and/or administrative basis for defining a "municipal system". In its proposed rules, the EPA indicates a preference for defining a municipal separate storm sewer system as one that is owned or operated by a single municipality, or "incorporated place", and meets the WQA population criteria for a large or medium municipal system. The EPA recognizes, however, that many municipal systems meeting this definition are associated with and usually, but not always, physically connected to municipal separate storm sewer systems that are owned and operated by entities other than the incorporated place. Such entities might include adjacent, smaller municipalities, or county agencies, State agencies, flood control districts or sewer districts which operate storm sewer systems within the boundaries of an incorporated place. In these situations, the EPA proposes that the Director of the NPDES program be given discretionary authority to adjust the scope and/or boundaries of large and medium municipal separate storm sewer systems to include discharges from associated municipal systems.

Although the EPA states its preference for the above approach, it requests comments on the following additional options for defining municipal separate storm sewer systems:

- designating systems owned and operated by counties with the appropriate population as municipal systems;

- designating state highway systems as a single municipal system requiring separate permits;

- using the boundaries of an incorporated place with the appropriate population to define a single municipal system. Under this option, separate storm sewer systems serving an incorporated place that are owned and operated by public entities other than municipal owner/operator would be automatically included in the municipal system without discretionary approval from the Director of the NPDES program;

- same as above, but using county boundaries to define a single municipal system; and

- using the boundaries of Census-defined urbanized areas to define municipal systems.

SYSTEM-WIDE PERMIT APPLICATIONS

Section 402(p)(3)(B)(i) of the 1987 WQA provides that permits for discharges from municipal separate storm sewer systems may be issued on a system-wide or jurisdiction-wide basis. The EPA favors this approach over the submittal of individual permit applications for each outfall. The system- wide permitting process will give municipal dischargers the opportunity to develop system-wide stormwater management programs which target controls based on an evaluation of priorities.

In addition, the EPA will encourage multiple municipal entities with stormwater management responsibilities within the same system to be co-applicants for a single system-wide permit. This approach will provide a basis for coordinated stormwater management planning and will spread, among the co-applicants, the burden of monitoring discharges, assessing water quality impacts, and developing and implementing controls. If this approach is undesirable, however, the EPA proposes that an individual municipal entity within a system be allowed to apply for a permit covering that portion of the storm sewer system for which they are responsible.

REQUIREMENT TO PROHIBIT NON-STORMWATER DISCHARGES

Section 402(p)(3)(B)(ii) of the 1987 WQA requires that permits issued for discharges from municipal separate storm sewers include a provision that "effectively prohibits" non- stormwater discharges into storm sewers. EPA's interpretation of this provision is that it is not meant to prohibit all discharges to municipal separate storm sewers that are not comprised entirely of stormwater. Rather, non-stormwater discharges to municipal systems may be allowed as long as they are covered by separate NPDES permits. The intent of this provision, according to EPA's interpretation, is to either remove or ensure NPDES permit coverage of illicit and untreated non-stormwater discharges to municipal storm sewers. To accomplish this, EPA's proposed permit application process would require municipal applicants to conduct a screening analysis and develop a site- specific management plan to identify and control improper disposal to their storm sewer systems.

RESPONSIBILITY FOR STORMWATER ASSOCIATED WITH INDUSTRIAL ACTIVITY THAT DISCHARGES TO MUNICIPAL SEPARATE STORM SEWERS

The EPA proposes to hold the operators of large and medium municipal separate storm sewer systems primarily responsible for applying for and obtaining NPDES permits covering not only system discharges, but stormwater discharges to the system as well. This approach would relieve those facilities which discharge stormwater associated with industrial activity to municipal separate storm sewers and meet certain conditions from having to obtain individual NPDES permits. The EPA proposes to define the term "associated with industrial activity" as "directly related to manufacturing, processing or raw material storage areas at an industrial plant." The proposed regulations supplement this definition by listing the types of facilities that would be defined as "industrial plants" and describing the types of areas within industrial plants that are directly related to industrial processes (see Section 122.26(b)(13)). The proposed definition of "associated with industrial activity" would not include "discharges associated with parking lots, and administrative and employee buildings."

To be exempt from having to obtain individual NPDES permits for their stormwater discharges, EPA proposes that industrial facilities meet the following conditions:

- The operator of an affected industrial facility must provide the operator of the municipal separate storm sewer a certification that the facility's stormwater discharge has been tested for the presence of non-stormwater discharges;

- The discharge from an industrial facility to a municipal storm sewer must be comprised entirely of stormwater;

- The discharge from an industrial facility to a municipal separate storm sewer must be in compliance with the management program established in the NPDES permit issued to the municipal operator; and

- The discharge from an industrial facility to a municipal separate storm sewer must not contain a hazardous substance in excess of the reporting quantities established under the WQA or the Comprehensive Environmental Response, Compensation, and Liability Act.

Under EPA's proposed permit application requirements, municipal operators would be required to identify the locations of facilities which discharge stormwater associated with industrial activity into their systems. They would also be required to incorporate measures into their stormwater management programs which would reduce, to the maximum extent practicable, pollutants in such discharges.

The EPA is also requesting comment on whether Federal facilities which discharge stormwater associated with industrial activity into municipal separate storm sewers should be required to obtain individual permits.

PROPOSED PERMIT APPLICATION REQUIREMENTS

STRUCTURE OF PERMIT APPLICATION

The EPA proposes a two-part application process for discharges from large and medium municipal storm sewer systems. The intended purpose of Part 1 of the permit application is to provide a basis for identifying the sources of pollutants contained in stormwater discharges; to preliminarily identify discharges that may require individual permits; and to formulate a strategy for characterizing stormwater discharges. The general components of Part 1 of the permit application, as proposed by the EPA, include:

- General information regarding the permit applicants or co-applicants;

- A description of existing legal authority to control pollutants in stormwater discharges, and a plan to augment such authority if necessary;

- Source identification information including a description of the historic use of ordinances or other controls which limited the discharge of non-stormwater to municipal systems, and the locations of known municipal separate storm sewer system outfalls;

- Information characterizing the nature of system discharges including existing quantitative data, the results of a field screening analysis to detect illicit discharges and illegal dumping into the municipal system, the development of a representative sampling program, a proposed plan to characterize discharges by estimating pollutant loads and concentrations, and an identification of receiving waters with known water quality problems associated with stormwater discharges;

- A description of existing structural and non-structural controls to reduce the discharge of pollutants from municipal storm sewers.

Part 2 of the permit application is designed to supplement information provided in Part 1 and to guide applicants in the preparation of comprehensive stormwater management programs. The permit authority will use the information presented in Part 2 to develop site-specific permit conditions which will be applicable for a five year term. EPA proposes that the general components of Part 2 of the permit application be as follows:

- A demonstration that legal authority of the permit applicant satisfies the regulatory criteria;

- Information added to Part 1 of the permit application, if necessary, to assure that all major outfalls are identified;

- Characterization of discharges from the municipal system including results from the screening analysis to detect illicit discharges, representative sampling data, and estimates of pollutant loadings and concentrations in discharges;

- A proposed stormwater management program to control the discharge of pollutants to the maximum extent practicable;

- An assessment of the performance of proposed controls;

- A financial analysis estimating the cost of implementing the proposed management program and an identification of sources of revenues; and

- A description of the roles and responsibilities of co-applicants.

The EPA has structured Parts 1 and 2 of the proposed permit application requirements to address four key issues. These include (1) the viability of local institutional mechanisms for controlling pollutants in stormwater discharges, (2) an identification of the sources of pollutants in stormwater discharges, (3) a characterization of stormwater discharges, and (4) the development of stormwater management programs. Specific permit information requirements for these areas of concern and proposed guidelines for collecting this information are briefly discussed below.

The Viability of Local Stormwater Management Programs

The EPA has identified, and incorporated into the proposed permit application requirements, three prerequisites for a viable stormwater management program. They are legal authority, adequate financial resources and adequate administrative capabilities. The EPA proposes that adequate legal authority be established through statutes, ordinances and/or contracts which authorize or enable the applicant to control pollutants in stormwater discharges, prohibit illicit discharges and control spills, require compliance with permit conditions, and carry out inspection and monitoring procedures.

The EPA has not proposed specific guidelines for determining the adequacy of financial resources and administrative capabilities. It does, however, request comments on these issues.

Source Identification

The source identification requirements of the proposed permit application are designed to determine the major sources in each drainage basin which contribute pollutants to a municipal separate storm sewer system. To fulfill the source identification requirements of Part 1 of the application, the EPA proposes that the applicant provide an inventory of all known major outfalls, and a proposed program to identify the locations of any major outfalls that have not yet been inventoried. The EPA defines an outfall as a point where a municipal system discharges to the waters of the United States. The EPA proposes to define a "major" outfall as a discharge pipe which either has a diameter of more than 36 inches (or drains an area of 50 acres or more), or drains land zoned for industrial activities and has a diameter of more than 12 inches (or drains an area of 2 acres or more). Applicants are required to identify major outfalls only, not the entire conveyance network of a municipal system.

The proposed Part 1 source identification requirements also include the delineation of drainage areas associated with known outfalls, a description of major land use classifications in each drainage area, ten year projections of population growth and development activities, a description of soils, and the location of industrial facilities, open dumps, landfills and RCRA hazardous waste facilities.

The source identification information required in Part 2 of the permit application will generally supplement the information reported in Part 1 by identifying all major outfalls.

Characterization of Discharges

As mentioned in the above description of the general components of Part 1 of the proposed permit application, the program to characterize discharges will consist of a screening analysis for illicit discharges, a representative sampling program, estimates of pollutant loadings and concentrations, and identification of receiving waters with known water quality impacts associated with stormwater discharges. The following summarizes the information requirements for each of these discharge characterization activities.

Screening Analysis for Illicit Discharges

The EPA proposes a two-phase screening analysis to be performed on major outfalls (as defined above) in municipal systems to detect illicit hookups and illegal dumping. The results of the first phase of this analysis, called the field screen, would be reported in Part 1 of the permit application and would be used to determine the priorities for the second phase of the analysis, the results of which would be included in Part 2 of the permit application. As proposed, the field screen would consist of visual observations of major outfalls during dry weather conditions. If any flow is observed, two grab samples would be collected during a 24 hour period (with a minimum period of four hours between samples). For these samples, a description of the color, odor, turbidity, the presence of oil sheen or surface scum, and any other relevant observations would be provided. In addition, the flow rate would be estimated, and field colormetric detection methods would be used to estimate pH, total chlorine, total copper, total phenol, total and hexavalent chromium, detergents (or surfactants) and free cyanide. Based on this initial screening, the applicant would submit a plan identifying major outfalls which deserve further study during the second phase of the analysis. The second phase of the screening analysis would require that both wet-weather and dry- weather samples be collected from the outfalls identified in the plan required in Part 1 of the application. These samples would be analyzed, using EPA approved techniques, for 20 pollutants which EPA has determined to be reliable indicators of illicit discharges and illegal dumping.

Representative Sampling Program

Because the pollutant concentrations in urban runoff can exhibit significant variation over time, the EPA is proposing that a monitoring plan be implemented as a permit condition and carried out during the term of the permit. In order to provide permit writers with the data necessary to develop site-specific monitoring requirements, all relevant existing data reported in Part 1 of the permit application would be considered. In addition, the EPA proposes that this information be verified and supplemented through sampling data collected by the applicant during

representative storm events for between five and ten outfalls. The locations of these outfalls, a schedule for sampling and a description of the proposed sampling equipment would be required in Part 1 of the permit application. It is proposed that the selected outfalls be representative of the commercial, residential and industrial activities of the drainage area contributing to the system. For at least one outfall, the applicant would be required to collect stormwater samples from three representative storm events that occur at least one month apart. Under the proposed requirements, the sampling data would be analyzed for a wide range of pollutants designated by the EPA including toxics and hazardous materials. The results of this analysis would be reported in Part 2 of the permit application. The permitting authority would use the results of this sampling process along with the existing quantitative data reported in Part 1 of the permit application to develop the ongoing monitoring program for the municipal system.

Estimates of Pollutant Loadings and Concentrations

An assessment of water quality impacts associated with municipal stormwater discharges requires an analysis of pollutant loadings and concentrations in discharges. EPA proposes that the annual pollutant load and the mean event concentration of the cumulative discharge from all outfalls (including outfalls not classified as major outfalls) in a system be estimated to assess both short and long term water quality impacts. The characterization of instream pollutant concentrations based on estimated mean event pollutant concentrations in system discharges is important in assessing short term impacts. Possible short term impacts include periodic dissolved oxygen depletion, high bacteria levels, fish kills, acute effects of toxic pollutants, contact recreation impairments and loss of submerged macrophytes. An estimate of annual pollutant loading associated with stormwater discharges is essential in assessing long term impacts. Such impacts include lack of storage capacity in water bodies, lake eutrophication, destruction of benthic habitat, depressed dissolved oxygen due to oxidation of organics in bottom sediments, and the biological accumulation of toxics. A plan for estimating pollutant loads and concentrations would be included in Part 1 of the permit application while actual estimates would be reported in Part 2. The EPA proposes that estimates be developed for BOD, COD, TSS, dissolved solids, total nitrogen, total ammonia plus organic nitrogen, total phosphorus, cadmium, copper, lead and zinc. The EPA would also require a description of the procedure used for arriving at these estimates.

Water Quality Impacts on Receiving Waters

Part 1 of the application would require that applicants list and briefly describe water quality impacts in water bodies which have been degraded as a result of discharges from municipal separate storm sewer systems. In compiling such a list and describing water quality impacts, the EPA proposes that the applicant use information from assessments required under sections 304, 305, 314, 319 and 320 of the WQA, and any available bottom sediment, fish tissue or biosurvey data.

The Development of Stormwater Management Programs

The NPDES permitting process for industrial process waste discharges and municipal sanitary sewers has relied on end-of- pipe, technology-based controls which can be uniformly applied to specific classes of discharges. The EPA has determined that this approach is inappropriate for municipal separate storm sewer discharges. Instead, the EPA is attempting to develop permit requirements that encourage the applicant to control pollutants in stormwater discharges through the development of flexible source-specific and site-specific stormwater management programs. The proposed permit application requirements are designed to give applicants the opportunity to develop locally appropriate control programs. Part 1 of the application would require a description of existing structural and non-structural control measures. Part 2 would require the applicant to identify additional measures that would be implemented during the term of the permit to control pollutants to the maximum extent practicable. These controls, if approved by the permitting authority, would then become permit conditions.

The proposed permitting regulations would require that Part 2 of the permit application describe stormwater management programs for four categories of stormwater discharges. These categories include (1) runoff from commercial and residential areas, (2) stormwater runoff from industrial areas, (3) runoff from construction sites, and (4) non-stormwater discharges. The proposed programs would not only describe control measures for each of these categories, but would propose implementation priorities as well. The EPA realizes that often discharges will be comprised of two or more of these categories. In these situations, control measures would need to be sufficient enough to reduce pollutants from multiple sources. The proposed permit application would require that the management programs for each category of discharge include consideration of certain types of control measures. A brief summary of the control measures that would have to be considered for each type of discharge is included below.

Runoff from Commercial and Residential Areas

A program to reduce pollutants in runoff from commercial and residential areas would be required to describe the following:

- Maintenance activities and a maintenance schedule for structural controls;
- Planning procedures including a comprehensive master plan to develop, implement and enforce controls to reduce the discharge of pollutants from areas of new development or significant redevelopment;
- Practices and procedures for operating and maintaining public streets, roads and highways to reduce the impact of runoff on receiving waters;

- Procedures to assure that flood management projects assess water quality impacts;

- A program to monitor pollutants from runoff from operating or closed municipal landfills or other treatment, storage or disposal facilities for municipal waste; and

- A program to reduce pollutants in stormwater discharges associated with the application of pesticides, herbicides and fertilizers.

Runoff from Industrial Areas

A program to monitor pollutants in runoff from industrial facilities that discharge to municipal separate storm sewers would be required to identify priorities and procedures for inspections, and establish and implement control measures.

Runoff from Construction Sites

A program to reduce pollutants in runoff from construction sites would be required to describe the following:

- Procedures for site planning which incorporate consideration of potential water quality impacts;

- Requirements for nonstructural and structural best management practices;

- Procedures for identifying priorities for inspecting sites and enforcing control measures; and

- Appropriate educational and training measures for construction site operators.

Non-Stormwater Discharges

A program to detect and remove, or require NPDES permits for, illicit discharges and improper disposal into storm sewers would be required to describe the following:

- A program, including inspections, to implement and enforce ordinances, orders or similar means to prevent illicit discharges;

- Sampling requirements for the following constituents: fecal coliform, fecal streptococcus, VOC, surfactants, and residual chlorine;

- Other testing programs based on smoke testing, and testing with flourometric dyes;

- Procedures to prevent, contain, and respond to spills that may discharge to storm sewers;

- A program to promote, publicize, and facilitate public reporting of the presence of illicit discharges or water quality impacts associated with discharges from storm sewers;

- Description of educational activities, public information activities, and other appropriate activities to facilitate the proper management and disposal of used oils and toxic materials; and

- Controls to limit infiltration of seepage from municipal sanitary sewers to municipal separate storm sewers.

In order to ensure that the required stormwater management programs are reducing pollutants in stormwater to the maximum extent practicable, as mandated by the 1987 WQA, the EPA is proposing that permittees submit annual status reports. These reports would be used by the permitting authority to aid in evaluating compliance with permit conditions and modifying permit conditions where necessary.

APPLICATION DEADLINES

The EPA proposes that, for large municipal systems, Part 1 of the permit application be submitted one year and Part 2 be submitted two years after publication of the final rule. The 1987 WQA requires that the final rule for large municipal systems be promulgated by February 4, 1989. The EPA was not be able to meet this deadline, however. As of this writing, the EPA doesnot expect the final rule to be promulgated until early 1990.

For medium municipal systems, the EPA proposes that Part 1 of the permit application be submitted by November 4, 1990 and that Part 2 be submitted be submitted by February 4, 1992. This assumes that the final regulations for medium municipal systems will be promulgated by February 4, 1990 as called for in the 1987 WQA.

IMPLICATIONS OF PROPOSED STORMWATER PERMITTING REGULATIONS FOR LOCALITIES

SOUTHEASTERN VIRGINIA LOCALITIES SUBJECT TO THE PROPOSED REGULATIONS

Of the eight Southeastern Virginia localities, only Virginia Beach, Norfolk, Chesapeake and Portsmouth would be subject to the proposed stormwater permitting regulations for medium and large municipal separate storm sewer systems proposed by the EPA. In accordance with the provisions of the 1987 WQA, the storm sewer systems serving Virginia Beach and Norfolk are considered large municipal systems, while the systems serving Chesapeake and Portsmouth are considered medium municipal systems. The only difference in the permitting regulations for large and medium municipal systems are the compliance deadlines. The 1987 WQA mandates that the application submittal and permit issuance deadlines for large municipal systems precede those for medium systems by two years.

Stormwater systems serving Southeastern Virginia localities with populations less than 100,000 (Franklin, Suffolk and the counties of Isle of Wight and Southampton) are exempt from NPDES permitting requirements until October 1, 1992 unless a stormwater discharge permit was issued prior to enactment of the WQA, or it is determined that a discharge contributes to a violation of water quality standards. The WQA mandates that, by October 1, 1992, the EPA must promulgate rules for regulating stormwater discharges from municipal systems serving populations less than 100,000. These rules will be based on the findings of two WQA mandated studies conducted to determine the most appropriate manner for regulating such systems.

THE DELINEATION OF MUNICIPAL SEPARATE STORM SEWER SYSTEMS IN SOUTHEASTERN VIRGINIA

As mentioned previously, the EPA proposes to define municipal separate storm sewer systems as those owned and operated by incorporated places meeting the population criteria contained in the WQA. The director of the permitting authority, however, could, on a case-by-case basis, adjust the scope and/or boundaries of a designated system to include discharges from other interrelated systems that are owned and operated by municipal entities other than the incorporated place. Such a determination would require the operators of the interrelated systems to become co-applicants for the same system-wide permit. This provision was developed primarily to address independent public entities such as flood control districts, sewer districts and county agencies which own and operate storm sewer systems within and in conjunction with systems owned and operated by incorporated places. Such public entities do not exist in the Southeastern Virginia localities subject to the proposed permitting regulations. There are at least two instances, however, that may cause the Director of the permitting authority to expand the scope of Southeastern Virginia's large and medium municipal separate sewer systems. The

first instance would involve storm sewers associated with a State highway running through a regulated community. These sewers may be determined by the permitting authority to be part of a designated municipal storm sewer system. In this situation, the Virginia Department of Transportation would be a co-applicant with the incorporated place. Another instance would be a municipal system owned and operated by one locality which discharges into a system owned and operated by another locality. If designated by the permitting authority to be a single municipal system, the two localities would be required to be co-applicants for the same permit. The extent to which these two situations would occur in Southeastern Virginia will depend on the interrelationships between local storm sewer systems, and the criteria used by the permitting authority to define interrelated systems.

The proposed regulations do not specifically address the status of systems that are interrelated to municipal systems, but are owned and operated by private, non-industrial entities (e.g., private residential subdivisions, large apartment complexes, office parks and so forth).

THE COST AND MANPOWER REQUIRED TO COMPLY WITH PERMITTING REQUIREMENTS

According to estimates developed by the EPA, the average application for a permit for all discharges from a large municipal system will require $131,200 and 8,534 hours to prepare. A permit application for all discharges from a medium municipal system would take an estimated $83,600 and 5,438 hours to prepare. These estimates only reflect the costs to prepare an application and do not include the costs that would be incurred in the implementation of the required stormwater management programs.

The actual costs, in time and money, of permit compliance could vary significantly depending on a variety of factors including:

- The size of a system;
- The necessity of applying for permits with co- applicants;
- The degree to which a municipal system receives illicit non-stormwater discharges, or stormwater associated with industrial activity;
- The availability of the resources needed to fulfill the proposed permit application requirements (i.e., money, manpower, sampling and testing equipment, expertise, and so forth); and
- The adequacy of local legal authority and administrative capabilities needed to implement a stormwater management program that meets EPA criteria.

Specific Federal funding assistance for preparing permit applications or complying with permit conditions was not provided for in the 1987 WQA. The EPA has proposed that selected communities participate in pilot programs that would assist the EPA in determining the cost and resources needed to comply with the proposed permitting regulations. The EPA has approached Southeastern Virginia localities through the Hampton Roads Water Quality Agency to determine whether they would be interested in participating in such a program. If the proposed pilot program is implemented, the EPA may be willing to provide limited contractor support to assist municipal personnel in preparing a permit application.

The EPA is also working with the United States Geological Survey (USGS) to determine the feasibility of providing USGS technical support to municipalities through cooperative funding programs. The USGS would aid municipalities in the collection of representative data required in the discharge characterization component of the permit application.

Another possibility for reducing the costs associated with permit preparation and compliance might be the establishment of a regional, cooperative stormwater management program. Such a program, which might be implemented by one or more existing regional entities (HRSD, SPSA, HRWQA or SVPDC), could provide the following benefits:

- Assistance to localities in the overall preparation of stormwater permit applications;

- A cooperative effort through which participating localities would share the cost of required discharge sampling and laboratory analysis activities. The services of a private contractor or an existing public agency (HRSD, VIMS or SWCB) might be secured for this effort;

- With the approval of the permitting authority, a regional representative sampling and monitoring program might substitute for the individual system-specific programs required in the proposed regulations;

- A regional forum through which information can be exchanged on the development and implementation of stormwater control strategies.

- A coordination of control strategies where a drainage basin is located in more than one locality.

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